digital

clinical lab 12

Summary Report Program Codes

A1,144
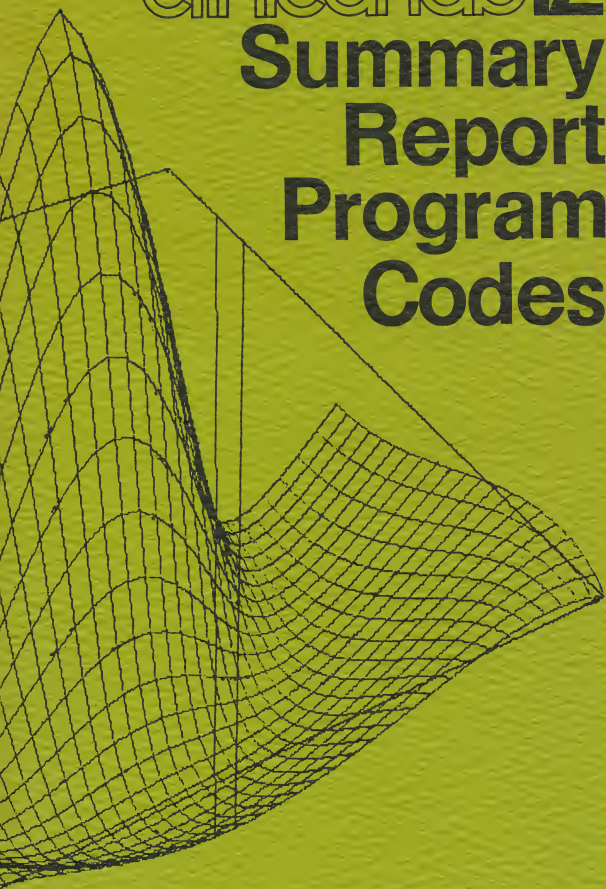
clinical lab12
Program List

Administrative Update	(AD)
Requisition Entry	(RE)
Work Sheet Generator	(WO)
Master Work Sheet	(SU,M)
Accession Number Entry	(AC)
Setup Analysis	(SE)
Update Test Results	(TE)
Patient Summary Printouts	(SU)
System Inquiry Program	(IN)
Delete Data	(DE)
Billing Routine	(SU,B)
Control/Schedule Block Gen	(CS)
Daily Test Census	(DA)
Display Channels	(DI)
Calculations	(CA)
Print Test Results	(PR)

ABSOLUTE LOADER

Starting Address: — 500
Memory Size:

4K	017
8K	037
12K	057
16K	077
20K	117
24K	137
28K	157
(or larger)	

BOOTSTRAP LOADER

Address	Contents	Address	Contents
— 744	016 701	— 764	000 002
— 746	000 026	— 766	— 400
— 750	012 702	— 770	005 267
— 752	000 352	— 772	177 756
— 754	005 211	— 774	000 765
— 756	105 711	— 776	177 560 (KB)
— 760	100 376		or 177 550 (PR)
— 762	116 162		

773 000 Paper Tape Bootstrap
773 100 Disk/DECtape Bootstrap
773 200 Card Reader Bootstrap

MR11-DB BOOTSTRAP LOADER

Device	Starting Address
RF11	773 100
RK11	773 110
TC11	773 120
TM11	773 136
RP11	773 154
RC11	773 220

7-BIT ASCII CODE

Octal Code	Char	Octal Code	Char	Octal Code	Char	Octal Code	Char
000	NUL	040	SP	100	@	140	`
001	SOH	041	!	101	A	141	a
002	STX	042	"	102	B	142	b
003	ETX	043	#	103	C	143	c
004	EOT	044	$	104	D	144	d
005	ENQ	045	%	105	E	145	e
006	ACK	046	&	106	F	146	f
007	BEL	047	'	107	G	147	g
010	BS	050	(	110	H	150	h
011	HT	051	)	111	I	151	i
012	LF	052	*	112	J	152	j
013	VT	053	+	113	K	153	k
014	FF	054	,	114	L	154	l
015	CR	055	—	115	M	155	m
016	SO	056	.	116	N	156	n
017	SI	057	/	117	O	157	o
020	DLE	060	0	120	P	160	p
021	DC1	061	1	121	Q	161	q
022	DC2	062	2	122	R	162	r
023	DC3	063	3	123	S	163	s
024	DC4	064	4	124	T	164	t
025	NAK	065	5	125	U	165	u
026	SYN	066	6	126	V	166	v
027	ETB	067	7	127	W	167	w
030	CAN	070	8	130	X	170	x
031	EM	071	9	131	Y	171	y
032	SUB	072	:	132	Z	172	z
033	ESC	073	;	133	[	173	{
034	FS	074	<	134	\	174	|
035	GS	075	=	135	]	175	}
036	RS	076	>	136	^	176	~
037	US	077	?	137	—	177	DEL

digital pdp11

PROGRAMMING CARD
FOR FAMILY OF PDP11 COMPUTERS

WORD FORMAT

15 14   12 11   9 8   6 5   3 2   0

BINARY-OCTAL REPRESENTATION
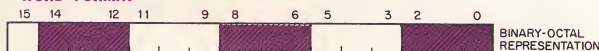
GENERAL REGISTER ADDRESSING

MODE	R

Mode	Name	Symbolic	Description
0	register	R	(R) is operand [ex. R2=%2]
1	register deferred	(R)	(R) is address
2	auto-increment	(R)+	(R) is adrs; (R) + (1 or 2)
3	auto-incr deferred	@(R)+	(R) is adrs of adrs; (R) + 2
4	auto-decrement	−(R)	(R) − (1 or 2); (R) is adrs
5	auto-decr deferred	@−(R)	(R) − 2; (R) is adrs of adrs
6	index	X(R)	(R) + X is adrs
7	index deferred	@X(R)	(R) + X is adrs of adrs

PROGRAM COUNTER ADDRESSING   Reg = 7

MODE	7

2	immediate	#n	operand n follows instr
3	absolute	@#A	address A follows instr
6	relative	A	instr adrs + 4 + X is adrs
7	relative deferred	@A	instr adrs + 4 + X is adrs of adrs

LEGEND

Op Codes

∎ = 0 for word/1 for byte
SS = source field (6 bits)
DD = destination field (6 bits)
R = gen register (3 bits), 0 to 7
XXX = offset (8 bits), +127 to −128
N = number (3 bits)
NN = number (6 bits)

Boolean

∧ = AND
∨ = inclusive OR
⩝ = exclusive OR
~ = NOT

Operations

( ) = contents of
s = contents of source
d = contents of destination
r = contents of register
← = becomes
X = relative address
% = register definition

Condition Codes

* = conditionally set/cleared
− = not affected
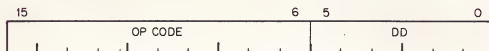0 = cleared
1 = set

NOTE:

▲ = Applies to the 11/40 & 11/45 computers
● = Applies to the 11/45 computer

digital equipment corporation

MAYNARD, MASSACHUSETTS   SEPT. 1972

SINGLE OPERAND: OPR dst

```
15                          6  5              0
 ┌──────────────────────────┬─────────────────┐
 │        OP CODE           │       DD        │
 └──────────────────────────┴─────────────────┘
```

Mnemonic	Op Code	Instruction	dst Result	N Z V C
General				
CLR(B)	■ 050DD	clear	0	0 1 0 0
COM(B)	■ 051DD	complement (1's)	~ d	* * 0 1
INC(B)	■ 052DD	increment	d + 1	* * * —
DEC(B)	■ 053DD	decrement	d − 1	* * * —
NEG(B)	■ 054DD	negate (2's compl)	−d	* * * *
TST(B)	■ 057DD	test	d	* * 0 0
Rotate & Shift				
ROR(B)	■ 060DD	rotate right	→C, d	* * * *
ROL(B)	■ 061DD	rotate left	C, d←	* * * *
ASR(B)	■ 062DD	arith shift right	d/2	* * * *
ASL(B)	■ 063DD	arith shift left	2d	* * * *
SWAB	0003DD	swap bytes		* * * 0
Multiple Precision				
ADC(B)	■ 055DD	add carry	d + C	* * * *
SBC(B)	■ 056DD	subtract carry	d − C	* * * *
▲SXT	0067DD	sign extend	0 or −1	— * * —

DOUBLE OPERAND: OPR src, dst   OPR src, R or OPR R, dst

```
15      12 11            6  5            0
 ┌────────┬──────────────┬───────────────┐
 │OP CODE │      SS      │      DD       │
 └────────┴──────────────┴───────────────┘

15            9 8  6  5                 0
 ┌─────────────┬──┬────────────────────┐
 │  OP CODE    │ R│     SS OR DD        │
 └─────────────┴──┴────────────────────┘
```
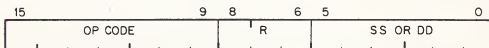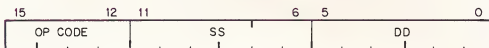
Mnemonic	Op Code	Instruction	Operation	N Z V C
General				
MOV(B)	■ 1SSDD	move	d ← s	* * 0 —
CMP(B)	■ 2SSDD	compare	s − d	* * * *
ADD	06SSDD	add	d ← s + d	* * * *
SUB	16SSDD	subtract	d ← d − s	* * * *
Logical				
BIT(B)	■ 3SSDD	bit test (AND)	s ∧ d	* * 0 —
BIC(B)	■ 4SSDD	bit clear	d ← (~s) ∧ d	* * 0 —
BIS(B)	■ 5SSDD	bit set (OR)	d ← s ∨ d	* * 0 —
▲Register				
MUL	070RSS	multiply	r ← r x s	* * 0 *
DIV	071RSS	divide	r ← r/s	* * * *
ASH	072RSS	shift arithmetically		* * * *
ASHC	073RSS	arith shift combined		* * * *
XOR	074RDD	exclusive OR	d ← r ∨ d	* * 0 —

BRANCH: B − − location

If condition is satisfied:
Branch to location,
New PC ← Updated PC + (2 x offset)

  └─── adrs of br instr + 2

```
15                    8  7              0
 ┌─────────────────────┬────────────────┐
 │     BASE CODE        │      XXX       │
 └─────────────────────┴────────────────┘
```
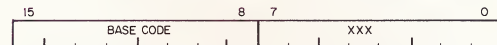
Op Code = Base Code + XXX

Mnemonic	Base Code	Instruction	Branch Condition	
Branches				
BR	000400	branch (unconditional)	(always)	
BNE	001000	br if not equal (to 0)	≠ 0	Z = 0
BEQ	001400	br if equal (to 0)	= 0	Z = 1
BPL	100000	branch if plus	+	N = 0
BMI	100400	branch if minus	−	N = 1
BVC	102000	br if overflow is clear		V = 0
BVS	102400	br if overflow is set		V = 1
BCC	103000	br if carry is clear		C = 0
BCS	103400	br if carry is set		C = 1
Signed Conditional Branches				
BGE	002000	br if greater or eq (to 0)	≥0	N ∀ V = 0
BLT	002400	br if less than (0)	<0	N ∀ V = 1
BGT	003000	br if greater than (0)	>0	Z v (N ∀ V) = 0
BLE	003400	br if less or equal (to 0)	≤0	Z v (N ∀ V) = 1
Unsigned Conditional Branches				
BHI	101000	branch if higher	>	C v Z = 0
BLOS	101400	branch if lower or same	≤	C v Z = 1
BHIS	103000	branch if higher or same	≥	C = 0
BLO	103400	branch if lower	<	C = 1

JUMP & SUBROUTINE:

Mnemonic	Op Code	Instruction	Notes
JMP	0001DD	jump	PC ← dst
JSR	004RDD	jump to subroutine	use same R
RTS	00020R	return from subroutine	
▲MARK	0064NN	mark	aid in subr return
▲SOB	077RNN	subtract 1 & br (if ≠ 0)	(R) − 1, then if (R) ≠ 0: PC ← Updated PC − (2 x NN)

TRAP & INTERRUPT:

Mnemonic	Op Code	Instruction	Notes
EMT	104000 to 104377	emulator trap (not for general use)	PC at 30, PS at 32
TRAP	104400 to 104777	trap	PC at 34, PS at 36
BPT	000003	breakpoint trap	PC at 14, PS at 16
IOT	000004	input/output trap	PC at 20, PS at 22
RTI	000002	return from interrupt	
▲RTT	000006	return from interrupt	inhibit T bit trap

MISCELLANEOUS:

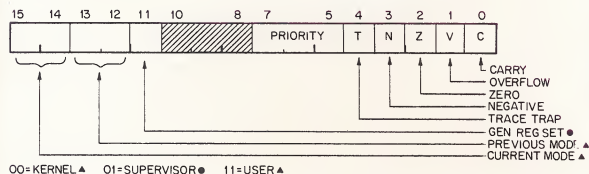| Mnemonic	Op Code	Instruction
HALT	000000	halt
WAIT	000001	wait for interrupt
RESET	000005	reset external bus
NOP	000240	(no operation)
●SPL	00023N	set priority level (to N)
▲MFPI	0065SS	move from previous instr space
▲MTPI	0066DD	move to previous instr space
●MFPD	1065SS	move from previous data space
●MTPD	1066DD	move to previous data space

CONDITION CODE OPERATORS:


```
15                          5 4 3 2 1 0
| OP CODE BASE = 000240      | | N Z V C |
```
O=CLEAR SELECTED COND CODE BITS
1=SET SELECTED COND CODE BITS
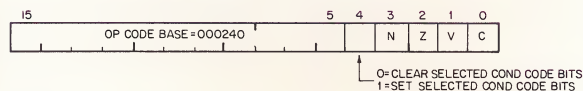
Mnemonic	Op Code	Instruction	N	Z	V	C
CLC	000241	clear C	–	–	–	0
CLV	000242	clear V	–	–	0	–
CLZ	000244	clear Z	–	0	–	–
CLN	000250	clear N	0	–	–	–
CCC	000257	clear all cc bits	0	0	0	0
SEC	000261	set C	–	–	–	1
SEV	000262	set V	–	–	1	–
SEZ	000264	set Z	–	1	–	–
SEN	000270	set N	1	–	–	–
SCC	000277	set all cc bits	1	1	1	1

PROCESSOR REGISTER ADDRESSES

Processor Status Word
PS - 777 776


```
15  14  13  12  11  10   8  7      5  4  3  2  1  0
|       |       |  |///////| PRIORITY | T | N | Z | V | C |
```
CARRY
OVERFLOW
ZERO
NEGATIVE
TRACE TRAP
GEN REG SET ●
PREVIOUS MODE ▲
CURRENT MODE ▲

OO=KERNEL▲ O1=SUPERVISOR● 11=USER▲

▲Stack Limit Register — 777 774

●Program Interrupt Request —777 772

General Registers (console use only)		
R0 — 777 700		R4 — 777 704
R1 — 777 701		R5 — 777 705
R2 — 777 702		R6 — 777 706
(not for 11/45) R3 — 777 703		R7 — 777 707

Console Switches & Display Register — 777 570

●FLOATING POINT:


```
15                    8  7  6  5        0
| OP CODE BASE =170000 | AC | SS OR DD |
```
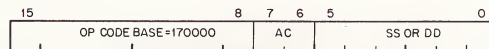
Mnemonic	Op Code	Instruction	Operation
CFCC	170000	copy fl cond codes	
SETF	170001	set floating mode	FD ← 0
SETI	170002	set integer mode	FL ← 0
SETD	170011	set fl dbl mode	FD ← 1
SETL	170012	set long integer mode	FL ← 1
LDFPS	1701 src	load FPP prog status	
STFPS	1702 dst	store FPP prog status	
STST	1703 dst	store (exc codes & adrs)	
CLRF, CLRD	1704 fdst	clear floating/double	fdst ← 0
TSTF, TSTD	1705 fdst	test fl/dbl	
ABSF, ABSD	1706 fdst	make absolute fl/dbl	fdst ←|fdst|
NEGF, NEGD	1707 fdst	negate fl/dbl	fdst ← –fdst
MULF, MULD	171 (AC) fsrc	multiply fl/dbl	AC ← AC x fsrc
MODF, MODD	171 (AC + 4) fsrc	multiply & integerize	
ADDF, ADDD	172 (AC) fsrc	add fl/dbl	AC ← AC + fsrc
LDF, LDD	172 (AC + 4) fsrc	load fl/dbl	AC ← fsrc
SUBF, SUBD	173 (AC) fsrc	subtract fl/dbl	AC ← AC — fsrc
CMPF, CMPD	173 (AC + 4) fsrc	compare fl/dbl (to AC)	
STF, STD	174 (AC) fdst	store fl/dbl	fdst ← AC
DIVF, DIVD	174 (AC + 4) fsrc	divide fl/dbl	AC ← AC/fsrc
STEXP	175 (AC) dst	store exponent	
STCFI, STCFL / STCDI, STCDL	175 (AC + 4) dst	store & convert fl or dbl to int or long int	
STCFD, STCDF	176 (AC) fdst	store & convert (dbl-fl)	
LDEXP	176 (AC + 4) src	load exponent	
LDCIF, LDCID / LDCLF, LDCLD	177 (AC) src	load & convert int or long int to fl or dbl	
LDCDF, LDCFD	177 (AC + 4) fsrc	load & convert (dbl-fl)	

PDP-11/40 FLOATING POINT UNIT:

			N	Z	V	C
FADD	07500R	floating add	*	*	0	0
FSUB	07501R	floating subtract	*	*	0	0
FMUL	07502R	floating multiply	*	*	0	0
FDIV	07503R	floating divide	*	*	0	0

FPP12

INSTRUCTION CARD

DATA REFERENCE INSTRUCTIONS

OP Code	Mnemonic	Data Function
0	FLDA	$C(Y) \rightarrow FAC$
1	FADD	$C(Y) + C(FAC) \rightarrow FAC$
5	FADDM	$C(Y) + C(FAC) \rightarrow Y$
2	FSUB	$C(FAC) - C(Y) \rightarrow FAC$
3	FDIV	$C(FAC)/C(Y) \rightarrow FAC$
4	FMUL	$C(FAC) * C(Y) \rightarrow FAC$
7	FMULM	$C(FAC) * C(Y) \rightarrow Y$
6	FSTA	$C(FAC) \rightarrow Y$

\# memory accesses $= 1 + D + IDX + INC + 2 * IND + M * (1 + MEM)$

D = 1 if double word instruction
   0 if single word instruction
IDX = 1 if the address is indexed
   0 if the address is not indexed
INC = 1 if the index register is incremented
   0 if the index register is not incremented
IND = 1 if an indirect address is used
   0 if an indirect address is not used

M = 2 if fixed-point mode
   3 if floating-point mode

MEM = 1 if the instruction is an ADD to memory or multiply to memory
   0 if the instruction is not an ADD to memory or multiply to memory.

DATA REFERENCE INSTRUCTION FORMATS

OP CODE	1	O	+	X	ADDRESS	
0	2	3	4	5 6 8	9 11	Double-word Data Ref. Instruction

ADDRESS	
12	23
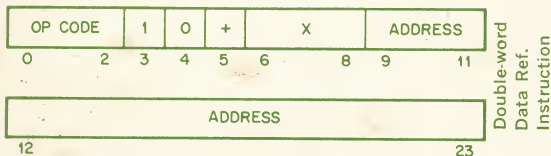
$Y = C \text{ (bits 9-23)} + M * [C (X + X0) + C \text{ (bit 5)}]_\delta (X)$

Single-word Direct Reference

OP CODE	O	1		OFFSET
0	2	3	4 5	11

$Y = C$ (base register) $+ 3 *$ (offset)

OP CODE	1	1	+	X	OFFSET
0	2	3	4	5 6	8 9 11

Single-word Indirect Reference

$Y = C$ [bits 21-36 of C(base reg.) $+ 3 *$ offset]
$\quad + (M) * [C (X + X0) + C$ (bit 5)$] \delta (X)$

$\delta (X) = \begin{matrix} 1 \text{ if } X \neq 0 \\ 0 \text{ if } X = 0 \end{matrix}$

SPECIAL FORMAT 1

OP Code	Mnemonic	Function	Memory Accesses
2	JXN	The index register X is incremented if bit 5 = 1 and a jump is executed to the address contained in bits 9-23 if index register X is nonzero.	2 + (inc) 1 + (jump) 1
3 4 5 6 7	Trapped Instructions	The "instruction trap" status bit is set and the FPP/12 exits causing a CPU interrupt. The unindexed operand address is dumped into the active parameter table.	2

OP CODE	O	O	+	X	ADDRESS
0	2	3	4	5 6	8 9 11

ADDRESS
12 23

Special
Format 1

SPECIAL FORMAT 2

OP Code	Extension	Mnemonic	Function	
0	10	LDX	The contents of the index register specified by bits 9-11 are replaced by the contents of bits 12-23.	3

OP Code	Extension	Mnemonic	Function	Memory Accesses
0	11	ADDX	The contents of bits 12-23 are added to the index register specified by bits 9-11.	4

Conditional Jumps

Jumps, if performed, are to the location specified by bits 9-23 of the instruction. All conditional jumps require 1 memory access if the test condition is false and 2 if the jump is executed.

OP Code	Extension	Mnemonic	Function
1	0	JEQ	Jump if the FAC $= 0$
1	1	JGE	Jump if the FAC $\geqslant 0$
1	2	JLE	Jump if the FAC $\leqslant 0$
1	3	JA	Jump always
1	4	JNE	Jump if the FAC $\neq 0$
1	5	JLT	Jump if the FAC < 0
1	6	JGT	Jump if the FAC > 0
1	7	JAL	Jump if impossible to fix the floating point number contained in the FAC; i.e., if the exponent is greater than $(23)_{10}$.

POINTER MOVES

OP Code	Extension	Mnemonic	Function	Memory Accesses
1	10	SETX	Set X0 to the address contained in bits 9-23 of the instruction.	2
1	11	SETB	Set the base register to the address contained in bits 9-23.	2
1	13	JSR	Jump and save return. The jump is to the location specified in bits 9-23 and the return is saved in bits 21-35 of the 1st entry of the data block.	4
1	12	JSA	An unconditional jump is deposited in the address and address + 1 where address is specified by bits 9-23. The FPC is set to address + 2.	4

OP CODE	O	O	EXTENSION	F
0	2	3 4	5 8	9 11

Y
12 23

Special
Format 2

SPECIAL FORMAT 3 INSTRUCTIONS

OP Code	Extension	Mnemonic	Function	Memory Accesses
0	1	ALN	The mantissa of the FAC is shifted until the FAC exponent equals the contents of the index register specified by bits 9-11. If bits 9-11 are zero, the FAC is aligned such that the exponent $= (23)_{10}$.[1] In Double Precision mode, an arithmetic shift is performed on the FAC fraction. The number of shifts is equal to the absolute value of the contents of the specified index register. The direction of shifting depends on the sign of the index register contents. A positive sign indicates a shift towards the least significant bit while a negative sign indicates a shift towards the most significant bit. The FAC exponent is not altered by the ALN instruction in double precision mode.	1 if bits 9-11 = 0, otherwise 2
0	2	ATX	The contents of the FAC is fixed and the least significant 12 bits of the mantissa are loaded into the index register specified by bits 9-11. In double precision mode the least significant 12 bits of the FAC are loaded into the specified index register. The FAC itself is not altered by the ATX instruction.	2
0	3	XTA	The contents of the index register specified by bits 9-11 are loaded right justified into the FAC mantissa. The FAC exponent is loaded with $(23)_{10}$ and then the FAC is normalized. The operation is typically termed floating a 12-bit number. In double precision mode the FAC is not normalized and the exponent is untouched.	2

[1] Setting the exponent $= (23)_{10}$ intergerizes or fixes the floating point number. The JAL instruction tests to see if fixing is possible.

OP Code	Extension	Mnemonic	Function	Memory Accesses
0	4	NOP	This single-word instruction performs no operation.	1

OPERATE GROUP—SPECIAL FORMAT 3

OP Code	Extension	9-11 Bits	Mnemonic	Function	Memory Accesses
0	0	0	FEXIT	Dump active registers into the active parameter table, reset the FPP/12 run flip flop to the 0 state, and interrupt the PDP processor.	3-8
0	0	1	FPAUSE	Wait for external synchronizing signal. This instruction is designed to cooperate with the AIP-12 option. IOT FPST (6555) will restart the FPP/12 executing the instruction following FPAUSE.	1
0	0	2	FCLA	Zero the FAC mantissa and exponent.	1
0	0	3	FNEG	Complement FAC mantissa.	1
0	0	4	FNORM	Normalize the FAC. In double precision mode FNORM is a NOP.	1
0	0	5	START F	Start floating-point mode.	1
0	0	6	START D	Start double-precision mode.	1
0	0	7	JAC	Jump to the location specified by the least significant 15 bits of THE FAC mantissa.	1

OP CODE	0	0	EXTENSION	F
0	2	3 4	5 8	9 11

Special
Format 3

IOT'S

FPINT	6551	Skip on FPP interrupt.
FPICL	6552	Clear the FPP interrupt flag and reset all important registers. FPICL is equivalent to an I/O present for the FPP.
FPCOM	6553	Load FPP command register and field bits of the APT pointer if:

    a) The FPP is not running and
    b) The FPP interrupt flag is reset.

FPHLT	6554	Force an FPP exit at the end of the current instruction.
FPST	6555	Load the 12-least significant 12-bits of the APT pointer and start if the FPP is

    a) not running and
    b) If the FPP interrupt flag is reset FPP will restart the FPP following an FPAUSE instruction without re-initialization.

If the FPP is started or restarted, FPST will skip.

FPRST	6556	Read the FPP status register into the AC.
FPIST	6557	Skip on the FPP interrupt flag. If the skip is granted, clear the flag, and read the FPP status into the AC.

FUNCTION OF PDP AC BITS WITH FPCOM (6553) IOT

AC0	Select double precision mode.
AC1	Exit on exponent underflow error.
AC2	Enable memory protection.
AC3	Enable interrupt.
AC4	Do not store op address on exits.
AC5	Do not store address of index registers on exits.
AC6	Do not store address of indirect pointer list on exits.
AC7	Do not store FAC of exits.
AC8	Lock out PDP12 CPU
AC9 AC10 AC11	4K field select bits of "Active Parameter Table" pointer.

PDP AC After Read Status IOT's— FPIST (6557) or FPRST (6556)

AC0	Double Precision Mode
AC1	Instruction Trap
AC2	C.P.U. Force Trap
AC3	Divide by Zero
AC4	Fraction Overflow (double precision mode only).
AC5	Exponent Overflow
AC6	Exponent Underflow
AC7 AC8 AC9	Unused
AC10	Paused
AC11	Run

ACTIVE PARAMETER TABLE FORMAT

Location

P	Field Bits of Operand Address	Field Bits of Base Reg.	Field Bits of Index Register Location	Field Bits of FPC
P+1	Lower 12 bits of FPC			
P+2	Lower bits of index reg. 0 location			
P+3	Lower bits of Base Reg.			
P+4	Lower bits of operand address			
P+5	Exponent of FAC			
P+6	MSW of FAC			
P+7	LSW of FAC			

Note: APT address points to location P.

Data Formats

Floating Point Format

Fixed Point Format

Both exponent and fractions are 2's complement forms.

1972

DEC DATASYSTEMS
700 SERIES

ON-LINE
MANAGEMENT
with
RSTS

digital

ORDER ENTRY MANAGEMENT WITH RSTS

Sales Administration

Processing orders can be a maze of paperwork, phone calls and general confusion when handled in the conventional manner. Is the stock in inventory? What's the color? Size? Quantity? Where's it warehoused? Is this a new order or a repeat? Rush or normal delivery? Enough lead time for a custom order? How's the buyer's credit?

With RSTS and your own applications software, you command a network capable of cutting order entry red tape to zero.

ON-LINE MANAGEMENT with RSTS

RSTS-11—the Resource Timesharing System from Digital Equipment Corporation—is a multi-user, interactive system which operates with the PDP-11 minicomputer.

Interactive timesharing used to be the province of larger, more expensive computer systems. DIGITAL brought the interactive terminal concept to the small user by developing a combination of low-cost computer hardware and sophisticated system software that puts RSTS in a unique, advanced class of timesharing system.

What is Interactive Timesharing?

Basically, interactive timesharing is two-way communication between the computer and remote terminal users. A typical application involves an operator using a combination keyboard/printer or keyboard/display terminal connected to the computer either directly or over ordinary telephone lines. The operator is guided by messages printed or displayed through the terminal. As data is entered, its validity is automatically checked by the computer program. Any error detected is immediately reported to the operator for correction.

On-line file updating is also possible with an interactive system. For example, a clerk can enter a product code which signals the program to "look up" the corresponding product record in a master disk file. The file is then displayed or printed at the terminal, permitting the clerk to update and verify the record.

TRADITIONAL APPROACH AND RSTS APPROACH

TRADITIONAL BATCH APPROACH		RSTS INTERACTIVE APPROACH	
Step	Operation	Step	Operation
1	Keypunch operator keys information into magnetic tapes or punched cards.	1	Clerk enters data into computer via on-line interactive terminal. Time-shared application program captures and verifies data. Clerk receives error messages immediately and responds with corrected data.
2	Data is verified with second keying operation.	2	Using data recorded in Step 1, records are automatically updated and reports are printed.
3	Cards or tapes are transported to a computer room and wait to be read into the computer.		
4	Cards or tapes are processed, records updated and reports printed.		
5	Report is sent to appropriate department. If any error—go back to Step 1.		

Production Control

With Production Control a part of the order entry team, you've formed the basis of a good management system. The production controller has full access to all order entry records. He knows immediately what lines are moving and he can use RSTS to compute a suitable production schedule. As new orders are received, revised delivery schedules are computed and printed out through both Production Control and Sales Administration terminals.

BENEFITS OF RSTS INTERACTIVE TIMESHARING

Reduced Clerical Costs

RSTS lets you automate the clerical steps required in routine business transactions. You save in applied clerical time and in reduced work volume.

Reduced Inventory Costs

With RSTS, inventory records are up to date, so buffer stock requirements can be reduced.

Reduced or Eliminated Batch Processing Overhead

RSTS is operated by regular clerical help. There's no need to support a separate batch data processing center. With interactive terminal usage, time-wasting, error-prone off-line data entry with subsequent verification steps is eliminated. Information is collected when it's generated and reports are printed where they're needed, reducing paper handling costs and making information more timely. On-the-spot answers can be requested on the status of any one of hundreds of separate transactions; there's no waiting for a batch printout.

Error-free Data Entry

Data entry errors are immediately identified and corrected using the "intelligence" of the interactive application program. The errors which might be introduced in an off-line key punch situation are eliminated.

Reduced Paperwork

Since records are automatically created and maintained in on-line disk files whenever information is entered, costly, error-prone filing is eliminated. Information is gathered at its source as created, reducing paper to working documents only.
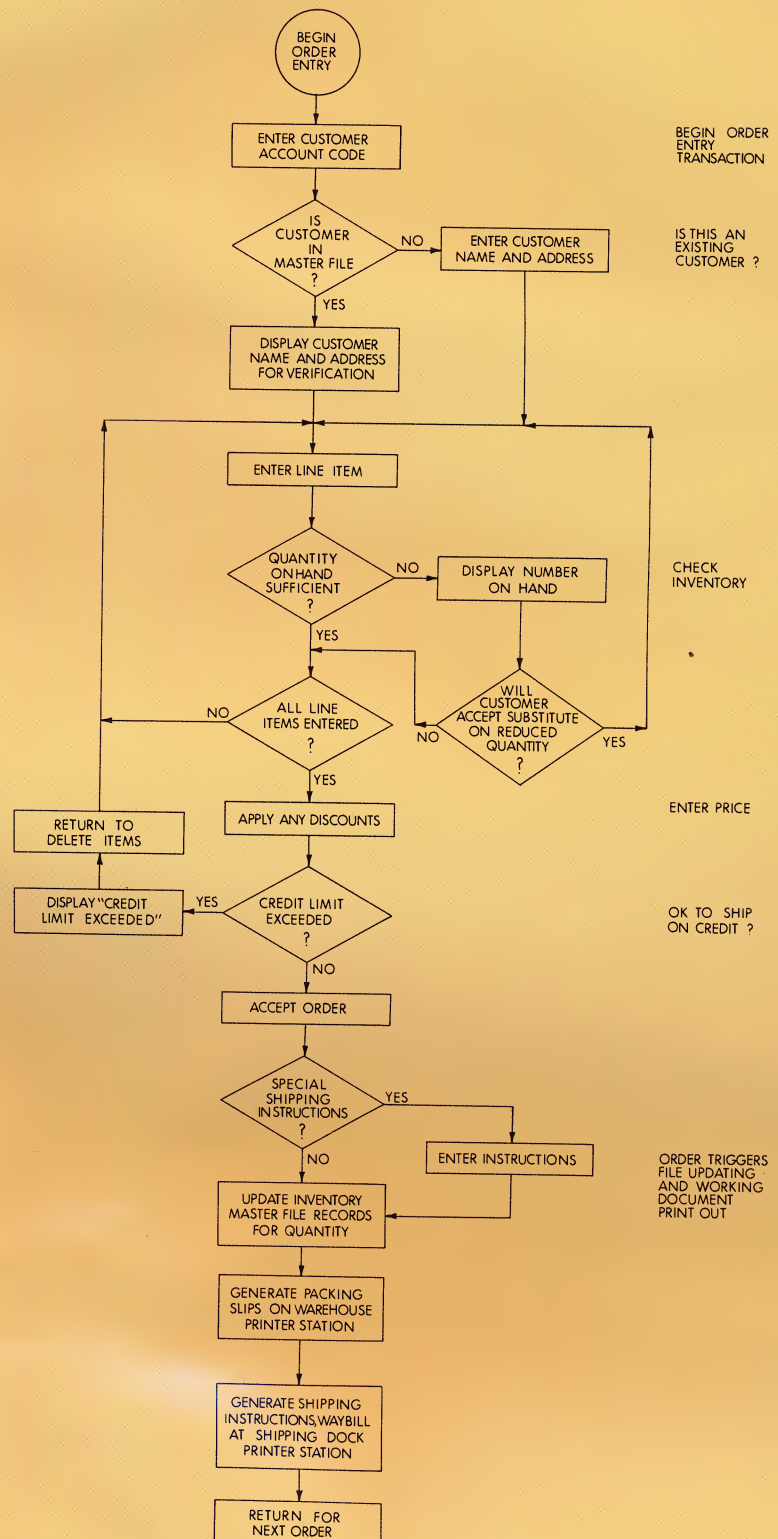
Instant Documents, Records, Invoices

Forms—shipping notices, receipts, bills of lading, invoices—are created automatically as desired.

Shipping

At the Shipping Dock, paperwork can really back things up. Not with RSTS. Shipping orders and bills of lading print out on the shipping department's terminal simply by typing in the coded order number. And back in Sales Administration, an invoice can be automatically printed.

Typical Order Entry Application

BEGIN ORDER ENTRY

ENTER CUSTOMER ACCOUNT CODE — BEGIN ORDER ENTRY TRANSACTION

IS CUSTOMER IN MASTER FILE ? — NO → ENTER CUSTOMER NAME AND ADDRESS — IS THIS AN EXISTING CUSTOMER ?

YES

DISPLAY CUSTOMER NAME AND ADDRESS FOR VERIFICATION

ENTER LINE ITEM

QUANTITY ON HAND SUFFICIENT ? — NO → DISPLAY NUMBER ON HAND — CHECK INVENTORY

YES

ALL LINE ITEMS ENTERED ? — NO

WILL CUSTOMER ACCEPT SUBSTITUTE ON REDUCED QUANTITY ? — NO / YES — ENTER PRICE

YES

APPLY ANY DISCOUNTS

RETURN TO DELETE ITEMS

CREDIT LIMIT EXCEEDED ? — YES → DISPLAY "CREDIT LIMIT EXCEEDED" — OK TO SHIP ON CREDIT ?

NO

ACCEPT ORDER

SPECIAL SHIPPING INSTRUCTIONS ? — YES → ENTER INSTRUCTIONS — ORDER TRIGGERS FILE UPDATING AND WORKING DOCUMENT PRINT OUT

NO

UPDATE INVENTORY MASTER FILE RECORDS FOR QUANTITY

GENERATE PACKING SLIPS ON WAREHOUSE PRINTER STATION

GENERATE SHIPPING INSTRUCTIONS, WAYBILL AT SHIPPING DOCK PRINTER STATION

RETURN FOR NEXT ORDER

Accounts Receivable

The final link, Accounts Receivable, can also be included in the system. Besides maintaining a file on each customer, they receive immediate notification of new orders and subsequent shipments. The system can be programmed to identify delinquent accounts and automatically type collection letters as well as periodically prepare billing statements.
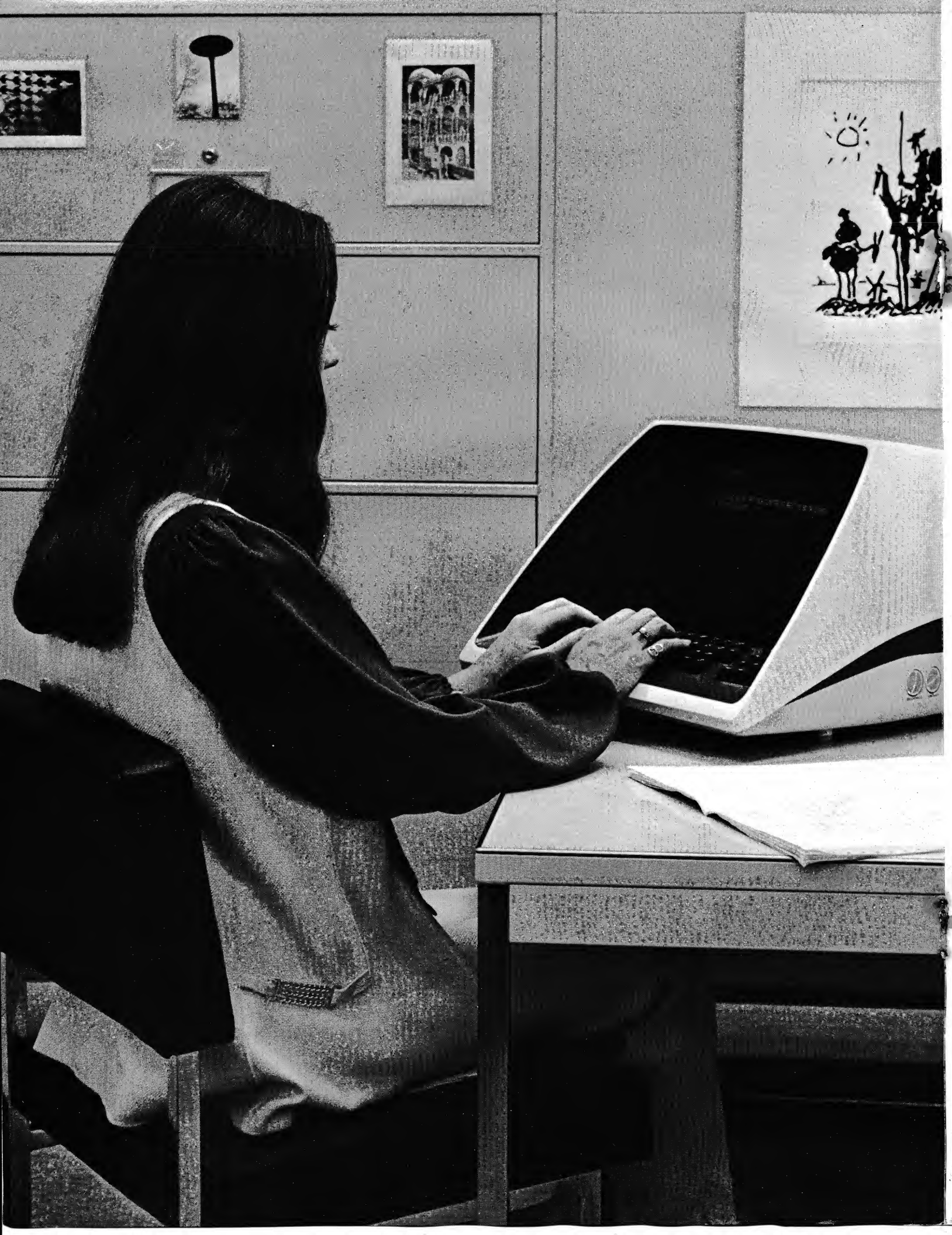
PERIPHERAL SUPPORT

RSTS accommodates high-speed peripherals in addition to interactive terminals and disk units. Peripherals which may be optionally included to meet processing needs are a line printer, punched card reader, industry-compatible magnetic tape, DIGITAL's unique, low-cost DECtape, and a high-speed papertape reader and punch. These peripherals are accessed by an interactive application program; for example, an interactive program might print invoices on the high-speed line printer and simultaneously update the customer disk file for accounts payable, while a terminal operator checks printouts indicating that credit limits are exceeded.

DIGITAL Magtape

In addition to disk units, another powerful RSTS mass storage capability is provided by DIGITAL's magtape transport. Each tape stores up to 12 million characters with the system supporting as many as eight tape drives. On-line mass storage capability of 160 million characters and unlimited off-line storage capability is possible. Magtape files provide a convenient medium for transferring data between RSTS and other data processing systems.

Receiving
RSTS at the Receiving Dock can produce daily lists of expected items keyed by Purchasing; incoming stock can be entered into the system and printouts produced at the buyer's terminal and Accounts Payable. File updates are easily handled through the order number.
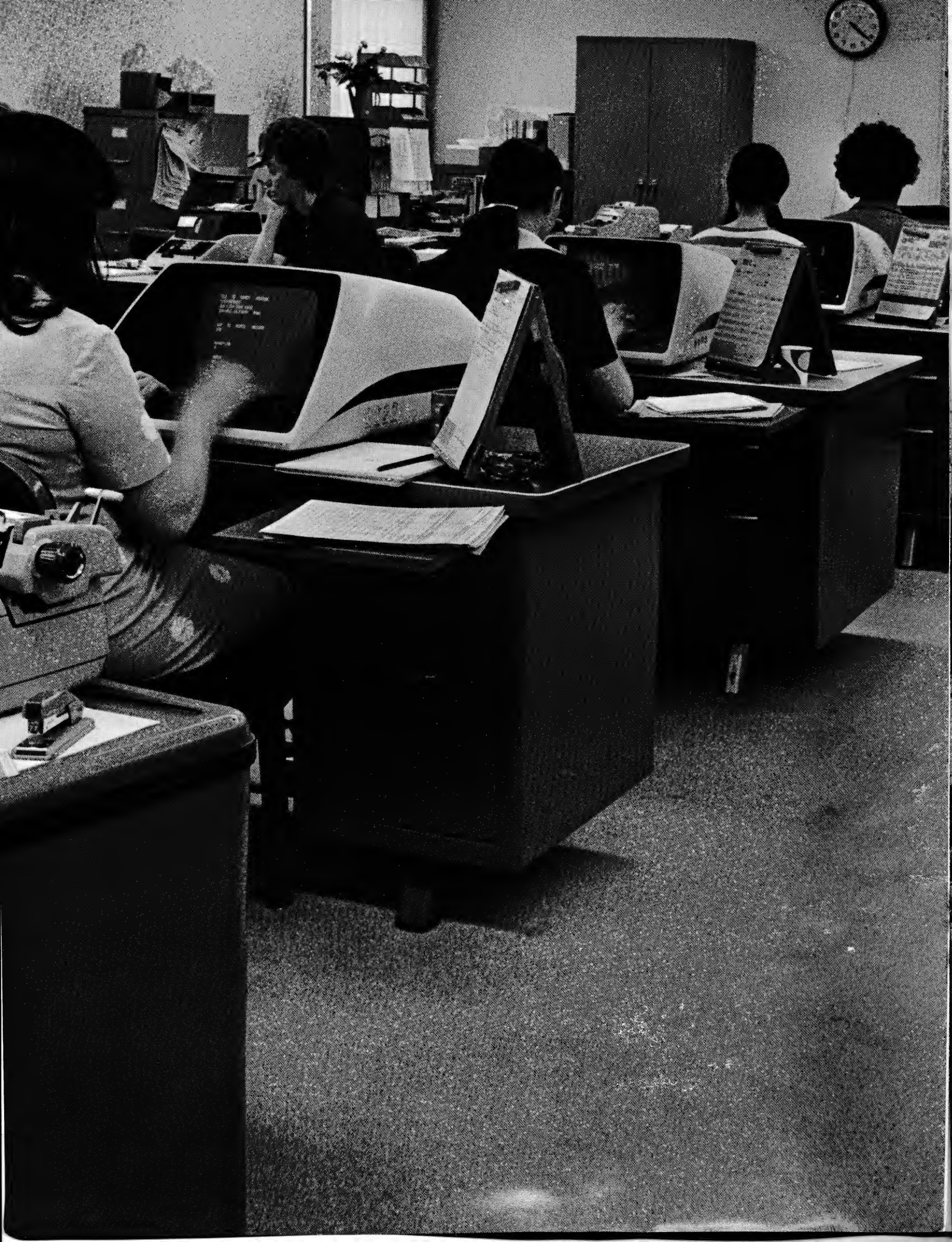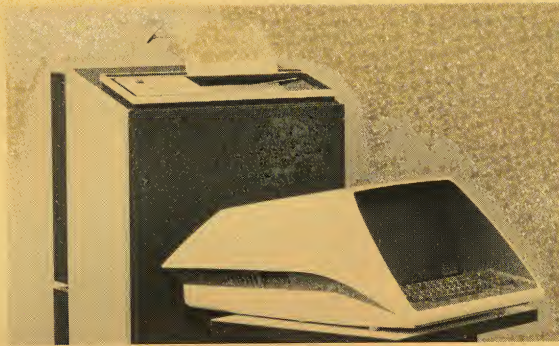
Line Printers

DIGITAL's high-speed line printers operate at up to 1000 lines per minute. Models are available for handling forms which are either 80- or 132-columns wide.

Punched Card Reader

For applications requiring punched cards, DIGITAL's rugged 80-column punched card reader may be included in the RSTS system. The card reader has a capacity of 300 cards per minute and handles 029, 026, or 1401 card codes.

DECwriter

The DECwriter keyboard offers standard typewriter keys and controls so the user immediately feels at home. To communicate with RSTS, the user simply types in data fields. When RSTS responds, the message appears on the printer portion of the DECwriter. For business applications requiring such forms as records, invoices, billings, etc., preprinted forms could be used.

DECdisplay

The DECdisplay is a cathode ray tube terminal which also uses a standard typewriter keyboard. It's an excellent display terminal for data entry purposes. The DECdisplay provides virtually silent operation, with output speeds as high as 120 characters per second.

Accounts Payable

Accounts Payable could consist of a simple printout of names and amounts owed, or RSTS could be programmed to handle complete bookkeeping, issuing checks at the close of the individual billing period.

APPLICATIONS PROGRAMMING

The computer programming language BASIC was originally developed at Dartmouth College so that students could have an easy-to-learn, easy-to-use programming language. Since then, BASIC has become one of the most popular interactive application programming languages. BASIC-Plus is a greatly enriched version used for writing application programs for RSTS. With BASIC-Plus, programs can be created for dedicated information-handling problems. Programmers who are familiar with other languages can learn to write application programs in BASIC-Plus after only a few hours of study.

Writing Programs In BASIC-Plus

BASIC-Plus programs are entered through any one of the RSTS interactive terminals. As BASIC-Plus program statements are typed in, RSTS checks their validity, responding at once if an error is detected. Valid statements are immediately compiled. Once the program is completely entered, it is ready for testing. Programs may be modified at any time from any terminal during program testing. This interactive nature of program development, in contrast to batch processing, greatly increases a programmer's productivity.

Inventory Control
Working with Purchasing, Production and Receiving, a dynamic system could be set up using RSTS that would virtually eliminate the necessity for periodic adjustment of inventory levels. Trends could be established and anticipated; minimum stock levels programmed; automatic reorder messages routed to Purchasing.

Customer Services

With RSTS, you get more than just hardware and software, because backup for DIGITAL products is almost as important as the products themselves. Once our field service engineers install your RSTS system and demonstrate its operation to your satisfaction, our relationship to you takes on an added dimension. You'll find an account representative happy to offer assistance or help solve special problems; and DIGITAL software specialists will provide advisory support on how you can use RSTS to solve your applications problems quickly and effectively.

Field service is provided through a worldwide network of service centers. You can obtain a service contract which provides for expenses, labor, and materials in maintaining your RSTS hardware system. Service is no further away than your telephone.

Developing Your RSTS Capability

DIGITAL offers one-week RSTS training courses in Maynard, Massachusetts and Palo Alto, California on a periodic basis. The course covers such system administration procedures as software loading, file backup procedures, and terminal user accounting facilities as well as an overview of BASIC-Plus language features and programming concepts and highlights of the theory of RSTS operation. Lectures and discussions are backed up with extensive hands-on experience using a RSTS system.

You will also be eligible for membership in DECUS, the Digital Equipment Computer Users Society, the most active computer users organization in the world. Through the DECUS semiannual meetings and periodic journal, you'll learn what other RSTS users are doing and be able to share software and exchange ideas.

Our goal and policy is to provide worldwide services covering aspects of software, maintenance, and training which assure you of a successful RSTS operating system and help you to develop capable specialists.

Like more information? Return the attached post card or call the nearest DIGITAL office.

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Specifically, I would like information about:

My needs are:　☐Immediate　☐Long Term　☐Reference Only

Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

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ECG
15

MUMPS
15

GRAPHIC
15

BATCH
15

RSX
15

PHA
15

1972

PDP-15
COMPUTER SYSTEMS

PRODUCTS
AND SERVICES

digital

PDP-15 COMPUTER SYSTEMS—PRODUCTS AND SERVICES

This comprehensive index to PDP-15 products and services provides complete prices for systems, options, software, and maintenance as well as basic information on software pricing, service options, and customer training.

The document also summarizes PDP-15 applications packages —BATCH-15, RSX PLUS, PHA-15, etc. This information, provided in Section I, outlines standard equipment and software, software support, maintenance, and training available, listing prices where applicable.

Section I can also be used as a pricing worksheet. Space has been allotted for additional options and prices so that all pertinent information and price totals can be contained on a single sheet.

NOTE: *All prices herein quoted are F.O.B. Maynard, Massachusetts, are valid only within the continental United States, and are subject to change without notice. All sales are subject to Digital Equipment Corporation's standard terms and conditions. For further information contact the PDP-15 Product Line (617) 897-5111 extensions 2352, 2873 or 2875.*

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APPLICATIONS PACKAGE PRICING SECTION I

BATCH-15

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/79	$ 91,000	
	Line Printer and Control	LP15-J	19,500	
	Card Reader and Control	CR15-D	10,000	
SOFTWARE	DOS-15	DOS15-A	n/c	
	BOSS-15	BOS15-A	2,500	
SOFTWARE SUPPORT	Installation plus 6-month warranty and update service		n/c	
HARDWARE MAINT.	Installation plus 90-day free parts and service		n/c	
TRAINING	8 training credits		n/c	
		BATCH-15 TOTAL	$123,000	
		ADDITIONAL ITEM TOTAL		
		COMPOSITE TOTAL		

RSX PLUS

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/77	$ 69,000	
	8K Core Memory (Additional)	ME15-C	8,000	
	Alphanumeric Terminal	VT05	2,795	
SOFTWARE	RSX PLUS	RSX15-B	5,000	
	RASP	RSP15-A	1,000	
	DOS-15	DOS15-A	n/c	
SOFTWARE SUPPORT	Installation plus 6-month warranty and update service		n/c	
HARDWARE MAINT.	Installation plus 90-day free parts and service		n/c	
TRAINING	8 training credits		n/c	
		RSX PLUS TOTAL	$ 85,795	
		ADDITIONAL ITEM TOTAL		
		COMPOSITE TOTAL		

PHA-15

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/75	$ 39,000	
	8K Core Memory (Additional)	ME15-B	8,000	
	Storage Tube Display, and Control	VP15-A	5,800	
	Tabletop Unit	NP15	5,900	
SOFTWARE	Advanced Software System (AADS)	ADS15-A	n/c	
	PHA-15 Applications Software		n/c	
	GASPAN Spectrum Analysis Package		n/c	
	ISOID Isotope Identification Package		n/c	
SOFTWARE SUPPORT	Installation plus 6-month warranty and update service		n/c	
HARDWARE MAINT.	Installation plus 90-day free parts and service		n/c	
TRAINING	6 training credits		n/c	

PHA-15 TOTAL $ 58,700

ADDITIONAL ITEM TOTAL _____

COMPOSITE TOTAL _____

GRAPHIC-15 (DECtape System)

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/75	$ 39,000	
	Graphics Terminal	GT15-S	24,000	
SOFTWARE	Advanced Software System	ADS15-A	n/c	
	Graphics Software Package			
	VT15 Handler			
	FORTRAN Callable Graphics Routines			
	Core and File Management Routines			
	Display Editor			
	3D Rotation			
	Handlers for Keyboard,			
	Writing Tablet, and Light Pen			
SOFTWARE SUPPORT	Installation plus 6-month warranty and update service		n/c	
HARDWARE MAINT.	Installation plus 90-day free parts and service		n/c	
TRAINING	6 training credits		n/c	

GRAPHIC-15 TOTAL $ 63,000

ADDITIONAL ITEM TOTAL _____

COMPOSITE TOTAL _____

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GRAPHIC-15 (DOS System)

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/75	$ 39,000	
	DECdisk Controller	RF15	6,000	
	DECdisk Fixed Head Disk	RS09	9,000	
	Graphics Terminal	GT15-S	24,000	
SOFTWARE	DOS-15	DOS15-A	n/c	
	Graphics Software Package		n/c	
SOFTWARE SUPPORT	Installation plus 6-month warranty and update service		n/c	
HARDWARE MAINT.	Installation plus 90-day free parts and service		n/c	
TRAINING	6 training credits		n/c	
		GRAPHIC 15 TOTAL	$ 78,000	
		ADDITIONAL ITEM TOTAL		
		COMPOSITE TOTAL		

GRAPHIC-15 (Resource Sharing System)

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/77	$ 69,000	
	8K Core Memory (Additional)	ME15-C	8,000	
	Graphics Terminal	GT15-S	24,000	
SOFTWARE	RSX PLUS	RSX15-B	5,000	
	Graphics/RSX Software (handles two display processors with two scopes on each)	RGX15-A	1,500	
SOFTWARE SUPPORT	Installation plus 6-month warranty and update service		n/c	
HARDWARE MAINT.	Installation plus 90-day free parts and service		n/c	
TRAINING	8 training credits		n/c	
		GRAPHIC-15 TOTAL	$107,500	
		ADDITIONAL ITEM TOTAL		
		COMPOSITE TOTAL		

ECG-1570
(1 ECG terminal, up to 60 ECG's per hour)

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/30		
	A/D Multiplexer	AD15		
	4-Channel A/D Module	BA124		
	Multi-Teletype Controller	LT19		
	Line Unit	LT19E		
	EIA Adapter	LT19F		
	Basic Mounting Unit	EP01		
	Single Channel Unit	EP01A		
	Clock and Tester	EP01C		
SOFTWARE	ECG-1570 Software including USPHS ECAN Analysis Program (Version D, Certified)			
SOFTWARE SUPPORT				
HARDWARE MAINT.	9-month warranty			
TRAINING				

ECG—1570 TOTAL	$ 84,900*
ADDITIONAL ITEM TOTAL	
COMPOSITE TOTAL	

*Package price only.

ECG-1580
(2 ECG terminals, up to 120 ECG's per hour)

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/35		
	8K Core Memory (Additional)	MM15-CC		
	A/D Multiplexer	AD15		
	8-Channel A/D Modules (2)	BA124		
	Multi-Teletype Controller	LT19		
	Line Units (2)	LT19E		
	EIA Adapters (2)	LT19F		
	Basic Mounting Unit	EP01		
	Single Channel Unit	EP01A		
	Expander Unit	EP01B		
	Clock and Tester	EP01C		
SOFTWARE	ECG-1580 Software including USPHS ECAN Analysis Program (Version D, Certified)			
SOFTWARE SUPPORT				
HARDWARE MAINT.	9-month warranty			
TRAINING				

ECG-1580 TOTAL	$122,830*
ADDITIONAL ITEM TOTAL	
COMPOSITE TOTAL	

*Package price only.

ECG-1590
(4 ECG terminals, up to 250 ECG's per hour)

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/40		
	8K Core Memory (Additional)	MM15-CC		
	A/D Multiplexer	AD15		
	12-Channel A/D Modules (3)	BA124		
	Multi-Teletype Controller	LT19		
	Line Units (4)	LT19E		
	EIA Adapter (4)	LT19F		
	Basic Mounting Unit (2)	EP01		
	Single Channel Unit (2)	EP01A		
	Expander Unit (2)	EP01B		
	Clock and Tester	EP01C		
SOFTWARE	ECG-1590 Software including USPHS ECAN Analysis Program (Version D, Certified)			
SOFTWARE SUPPORT				
HARDWARE MAINT.	9-month warranty			
TRAINING				

	ECG-1590 TOTAL	$162,400*	
	ADDITIONAL ITEM TOTAL		
	COMPOSITE TOTAL		

*Package price only.

MUMPS-15
(System 1 for 5-7 users—1/2 million word data base)

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/75	$ 39,000	
	DECdisk Controller	RF15	6,000	
	DECdisks (2)	RS09	18,000	
	Line Scanner	DC01-ED	6,000	
SOFTWARE	MUMPS Operating System and Interpreter MUPAK Disk Initialization and Backup Package MUBOOT Bootstrap Loader MULOAD System Builder		4,500	
SOFTWARE SUPPORT	14 cumulative days of software support during 6 months following installation		incl. in software price	
HARDWARE MAINT.	Installation plus 90-day free parts and service		n/c	
TRAINING	6 training credits On site operator training		incl. in software price	

	MUMP-15 TOTAL	$ 73,500	
	ADDITIONAL ITEM TOTAL		
	COMPOSITE TOTAL		

MUMPS-15
(System 2 for 5-7 users—10 million word data base)

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/75	$ 39,000	
	Line Scanner	DC01-ED	6,000	
	Disk Pack Controller	RP15	18,000	
	Disk Pack	RP02	18,000	
	Magnetic Tape Drive	TU10A	6,950	
	Magnetic Tape Transport	TC59A	6,950	
SOFTWARE	MUMPS Operating System and Interpreter		4,500	
	MUPAK Disk Initialization and Backup Package			
	MUBOOT Bootstrap Loader			
	MULOAD System Builder			
SOFTWARE SUPPORT	14 cumulative days of software support during 6 months following installation		incl. in software price	
HARDWARE MAINT.	Installation plus 90-day free parts and service		n/c	
TRAINING	6 training credits On site operator training		incl. in software price	

MUMPS-15 TOTAL $ 99,400
ADDITIONAL ITEM TOTAL _____
COMPOSITE TOTAL _____

MUMPS-15
(System 3 for 10-12 users—20 million word data base)

		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/75	$ 39,000	
	Line Scanner (2)	DC01-ED	12,000	
	8K Core Memory (Additional)	ME15-B	8,000	
	Disk Pack Controller	RP15	18,000	
	Disk Pack (2)	RP02	36,000	
SOFTWARE	MUMPS Operating System and Interpreter		4,500	
	MUPAK Disk Initialization and Backup Package			
	MUBOOT Bootstrap Loader			
	MULOAD System Builder			
SOFTWARE SUPPORT	14 cumulative days of software support during 6 months following installation		incl. in software price	
HARDWARE MAINT.	Installation plus 90-day free parts and service		n/c	
TRAINING	6 training credits On site operator training		incl. in software price	

MUMPS-15 TOTAL $117,500
ADDITIONAL ITEM TOTAL _____
COMPOSITE TOTAL _____

APPLICATIONS PACKAGE PRICING

MUMPS-15 (System 4 for 18-20 users—20 million word data base)		MODEL	PRICE STANDARD ITEMS	PRICE ADDITIONAL ITEMS
HARDWARE	Computer System	PDP-15/75	$39,000	
	16K Core Memory (Additional)	ME15-F	14,000	
	Line Scanners (3)	DC01-ED	18,000	
	Disk Pack Controller	RP15	18,000	
	Disk Packs (2)	RP02	36,000	
	Magnetic Tape Drive	TU10A or B	6,950	
	Magnetic Tape Controller	TC59D	6,950	
	Line Printer	LP15F	14,000	
SOFTWARE	MUMPS Operating System and Interpreter		4,500	
	MUPAK Disk Initialization and Backup Package			
	MUBOOT Bootstrap Loader			
	MULOAD System Builder			
SOFTWARE SUPPORT	14 cumulative days of software support during 6 months following installation		incl. in software price	
HARDWARE MAINT.	Installation plus 90-day free parts and service		n/c	
TRAINING	6 training credits		n/c	
	One week MUMPS language training		incl. in	
	On site operator training		software price	
		MUMPS-15 TOTAL	$157,400	
		ADDITIONAL ITEM TOTAL		
		COMPOSITE TOTAL		

COMPUTER SYSTEMS   SECTION II-A

	Package Price	1-Shift Service per Month	Discount Status

PDP-15 SERIES 70 COMPUTER SYSTEMS WITH ME15 MEMORY

PDP-15/73-A Computer System (115V 60Hz).
PDP-15/73-B Computer System (230V 50Hz). $ 31,500 $300   Yes

- KP15 Central Processor
- 16,384 words ME15 Core Memory
- LA30 DECwriter
- PC15 High Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- KW15 Real Time Clock

PDP-15/75-A Computer System (115V 60Hz).
PDP-15/75-B Computer System (230V 50Hz).   39,000   350   Yes

- KP15 Central Processor
- 16,384 words ME15 Core Memory
- LA30 DECwriter
- PC15 High Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- KW15 Real Time Clock
- TC15 DECtape Control
- TU56 Dual DECtape Transport

PDP-15/77-A Computer System (115V 60Hz).
PDP-15/77-B Computer System (230V 50Hz).   69,000   550   Yes

- KP15 Central Processor
- 24,576 words ME15 Core Memory
- LA30 DECwriter
- PC15 High Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- KW15 Real Time Clock
- TC15 DECtape Control
- TU56 Dual DECtape Transport
- RF15 DECdisk Control
- RS09 DECdisk Drive, 262,144 words
- KM15 Memory Protect
- KT15 Memory Relocate
- KA15 Automatic Priority Interrupt
- LT15-A Single Teletype Control

PDP-15/79-A Computer System (115V 60Hz).
PDP-15/79-B Computer System (230V 50Hz).   91,000   730   Yes

- KP15 Central Processor
- 16,384 words ME15 Core Memory
- LA30 DECwriter
- PC15 High Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- KW15 Real Time Clock
- TC59 Magnetic Tape Control
- TU10 Magnetic Tape Transport
- FP15 Floating Point Processor
- RP15 Disk Pack Control
- RP02 Disk Pack

	Package Price	1-Shift Service per Month	Discount Status

PDP-15 COMPUTER SYSTEMS WITH MM/MK15 MEMORY

	Package Price	1-Shift Service per Month	Discount Status
PDP-15/10 Computer System.	$ 16,500	$200	Yes

- KP15 Central Processor
- 4,096 words 18-bit, 800-ns Core Memory
- ASR-33 Teletype

	Package Price	1-Shift Service per Month	Discount Status
PDP-15/20 Computer System.	36,000	330	Yes

- KP15 Central Processor
- 8,192 words 18-bit, 800-ns Core Memory
- KSR-35 Teletype
- PC15 High Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- TC15 DECtape Control
- TU56 Dual DECtape Transport

	Package Price	1-Shift Service per Month	Discount Status
PDP-15/30 Computer System.	59,200	480	Yes

- KP15 Central Processor
- 16,384 18-bit, 800-ns Core Memory
- KSR-35 Teletype for BACKGROUND use
- KSR-33 Teletype for FOREGROUND use
- LT15-A Single Teletype Control
- PC15 High Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- KA15 Automatic Priority Interrupt
- KM15 Memory Protect
- KW15 Real Time Clock
- TC15 DECtape Control
- (2) TU56 Dual DECtape Transports

	Package Price	1-Shift Service per Month	Discount Status
PDP-15/35 Computer System.	67,000	495	Yes

- KP15 Central Processor
- 16,384 words 18-bit, 800-ns Core Memory
- KSR-35 Teletype
- PC15 High Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- KA15 Automatic Priority Interrupt
- KW15 Real Time Clock
- TC15 DECtape Control
- TU56 Dual DECtape Transport
- RF15 DECdisk Control
- RS09 DECdisk Drive 262,144 words

	Package Price	1-Shift Service per Month	Discount Status
PDP-15/40 Computer System.	91,000	630	Yes

- KP15 Central Processor
- 24,576 word 18-bit, 800-ns Core Memory
- KSR-35 Teletype for BACKGROUND use
- KSR-33 Teletype for FOREGROUND use
- LT15-A Single Teletype Control
- PC15 High Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- KA15 Automatic Priority Interrupt
- KM15 Memory Protect
- KW15 Real Time Clock
- TC15 DECtape Control
- TU56 Dual DECtape Transport
- RF15 DECdisk Control
- (2) RS09 DECdisk Drives 262,144 words each

	Package Price	1-Shift Service per Month	Discount Status
PDP-15/50 Computer System.	$108,900	$648	Yes

- KP15 Central Processor
- 16,384 word 18-bit, 800-ns Core Memory
- KSR-35 Teletype
- KE15 Extended Arithmetic Element
- KW15 Real Time Clock
- PC15 High Speed Paper Tape Reader and Punch
- FP15 Floating Point Processor
- RP15 Disk Pack Control
- RP02 Disk Pack Drive, 10.24 million words
- TC59 Magnetic Tape Control
- TU10 Magnetic Tape Transport

CPU OPTIONS SECTION II-B

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
KE15	Extended Arithmetic Element. Hardware multiply and divide. Worst case multiply time 7.4 μsec. Worst case divide time 7.6 μsec.	None	$ 2,800	$25	$ 60	Yes
KM15	Memory Protect. Hardware protection boundary. Program controlled boundary value Traps IOT, Halt, OAS, XCT of XCT instructions. Cannot be expanded to KT15 memory relocation.	BB15	2,900	14	100	Yes
KT15	Memory Relocation. Hardware relocation by means of program controlled register. Upper and lower memory protection boundaries. Traps IOT, Halt, OAS, XCT of XCT instructions. Includes Memory Protection (Protection or Relocation switch selectable).	KM15 and	3,000	30	100	Yes
KF15	Power Fail. Interrupts computer on power failure to allow execution of register saving routines (auto restart).	None	1,000	3	60	Yes
FP15	Floating Point Processor.* High speed 16 μsec. Floating point multiplication. One part per billion accuracy. Arithmetic operations performed 10 times faster than with software routines.	KE15	12,000	75	400	Yes
KA15	Automatic Priority Interrupt. 4 hardware priority levels for up to 28 devices. Up to 8 devices on a single priority level. 4 software priority levels.	BB15	3,900	20	100	Yes
KW15	Real Time Clock. Line frequency clock (60Hz/50Hz), increments Memory Location 7. Variable frequency available with additional M401 module (RC Clock). Crystal controlled frequency available with addition of M405 module (frequency to be specified when ordering).	None	500	3	60	Yes
DW15-A	I/O Bus Converter. Positive to negative I/O Bus converter. Allows use of PDP-9 (negative logic) peripherals VP15 options.	None	2,000	20	100	Yes
BA15	Control for LT15A, PC15, NP15 options	None	*	10	—	—
BB15	Processor Expander Panel.	None	**	10	60	—

*Supplied free with LT15A, PC15, or VP15 options.
**Supplied free with purchase of KT15, KM15, or KA15 options.

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
MEMORY MULTIPLEXER						
MX15	Memory Multiplexer. Allows access of up to 128K of MM15 Memory. Allows direct memory access of external devices. Allows multi-processor systems on common memory. Note: one MX15 required for each 32K of MM15 memory in systems with more than 32K of memory.	None	$ 5,000	$50	$300	Yes
ME15 EXPANDER CORE MEMORY						
8K Blocks						
ME15-AA	8K Memory System. (115V 60Hz) 18-bit read/write 980-ns nominal core. Self contained in rack mountable unit. Includes power supply, mounting hardware, back panel (wired for up to 24K) and first 8K of ME15 memory.	None	8,000	40	300	Yes
	*Minimum memory required for use with: ADSS & DOS—16K RSX PLUS—24K					
ME15-AB	8K Memory System. Same as ME15-AA except (230V 50Hz).	None	8,000	40	300	Yes
ME15-B	8K Memory Expansion Element. Used with ME15-A, ME15-C, and ME15-D options.	ME15-A or ME15-C or ME15-D	8,000	40	300	Yes
ME15-C	8K Memory Expander Unit. Accommodates ME15 memory expansion into second or fourth 24K segments.	ME15-A or ME15-D	8,000	40	300	Yes
ME15-D	8K Memory Expander Unit. Accommodates ME15 memory expansion into third 24K segment.	ME15-A	8,000	40	300	Yes
16K Blocks						
ME15-EA	16K Memory Option. Contains a ME15-AA plus a single ME15-B option. Implement for first 16K of ME15 memory. (115V 60Hz)	None	14,000	80	425	Yes
ME15-EB	16K Memory Option. Same as ME15-EA except it contains ME15-AB (230V 50Hz).	None	14,000	80	425	Yes
ME15-F	16K Memory Option. Contains a ME15-C plus a single ME15-B option.	ME15-A	14,000	80	425	Yes
ME15-H	16K Memory Option. Contains a ME15-D plus a single ME15-B option.	ME15-A	14,000	80	425	Yes
ME15-J	16K Memory Option. Contains two ME15-B options.	ME15-A or ME15-C or ME15-D	14,000	80	250	Yes

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MEMORY OPTIONS   SECTION II-C

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
MEMORY MULTIPLEXER						
MX15	Memory Multiplexer. Allows access of up to 128K of MM15 Memory. Allows direct memory access of external devices. Allows multi-processor systems on common memory. Note: one MX15 required for each 32K of MM15 memory in systems with more than 32K of memory.	None	$ 5,000	$50	$300	Yes
ME15 EXPANDER CORE MEMORY						
8K Blocks						
ME15-AA	8K Memory System. (115V 60Hz) 18-bit read/write 980-ns nominal core. Self contained in rack mountable unit. Includes power supply, mounting hardware, back panel (wired for up to 24K) and first 8K of ME15 memory.	None	8,000	40	300	Yes

*Minimum memory required for use with:
ADSS & DOS—16K
RSX PLUS—24K

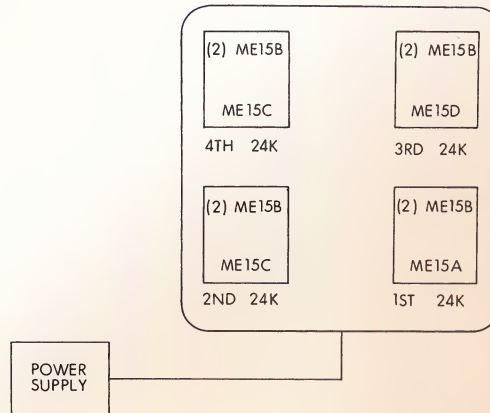| Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
ME15-AB	8K Memory System. Same as ME15-AA except (230V 50Hz).	None	8,000	40	300	Yes
ME15-B	8K Memory Expansion Element. Used with ME15-A, ME15-C, and ME15-D options.	ME15-A or ME15-C or ME15-D	8,000	40	300	Yes
ME15-C	8K Memory Expander Unit. Accommodates ME15 memory expansion into second or fourth 24K segments.	ME15-A or ME15-D	8,000	40	300	Yes
ME15-D	8K Memory Expander Unit. Accommodates ME15 memory expansion into third 24K segment.	ME15-A	8,000	40	300	Yes
16K Blocks						
ME15-EA	16K Memory Option. Contains a ME15-AA plus a single ME15-B option. Implement for first 16K of ME15 memory. (115V 60Hz)	None	14,000	80	425	Yes
ME15-EB	16K Memory Option. Same as ME15-EA except it contains ME15-AB (230V 50Hz).	None	14,000	80	425	Yes
ME15-F	16K Memory Option. Contains a ME15-C plus a single ME15-B option.	ME15-A	14,000	80	425	Yes
ME15-H	16K Memory Option. Contains a ME15-D plus a single ME15-B option.	ME15-A	14,000	80	425	Yes
ME15-J	16K Memory Option. Contains two ME15-B options.	ME15-A or ME15-C or ME15-D	14,000	80	250	Yes

SELECTING THE CORRECT ME15 MEMORY UNIT

Ordering in 8K Blocks		Ordering in 16K Blocks	
Block of ME15 Memory being ordered*	Option Number	Block of ME15 Memory being ordered	Option Number
0— 8K	ME15-A**	0—16K	ME15-E**
8—16K	ME15-B	8—24K	ME15-J
16—24K	ME15-B	16—32K	ME15-F
24—32K	ME15-C	24—40K	ME15-F
32—40K	ME15-B	32—48K	ME15-J
40—48K	ME15-B	40—56K	ME15-H
48—56K	ME15-D	48—64K	ME15-H
56—64K	ME15-B	56—72K	ME15-J
64—72K	ME15-B	64—80K	ME15-F
72—80K	ME15-C	72—88K	ME15-F
80—88K	ME15-B	80—96K	ME15-J
88—96K	ME15-B		

*When ordering ME15 memory disregard MM/MK memory if already installed in system.
**ME15-A and ME15-E modules contain power supplies and require suffix A for 115V, 60Hz and B for 230V, 50Hz. For example, ME15-AB has a 230V, 50Hz power supply.

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
800 NANOSECOND CORE MEMORY						
4K Blocks						
MM15-AB	4K, 18-bit MM15 Memory System 800-ns. (With space to add additional MK15-A) Expands 8K MM15 system to 12K (first bank on CPU back door).	PDP-15	$ 8,000	$25	$100	Yes
MM15-AC	4K, 18-bit MM15 Memory System 800-ns. Expands 16K memory to 20K (second bank on back door) or 28K memory to 32K (third bank on back door of CPU).	PDP-15	8,000	25	100	Yes
MK15-A	4K, 18-bit Memory Expansion Module. Expands MM15-AB and MM15-AC to 8K bank.	MM15-AB or MM15-AC	6,000	25	60	Yes
8K Blocks						
MM15-CB	8K, 18-bit MM15 Memory Option. Expands MM15 memory system from 8K to 16K configuration (first 8K mounted on back door of CPU).	MM15-AB or MM15-AC + MK15-A	11,000	50	125	Yes
MM15-CC	8K, 18-bit MM15 Memory Option. Expands MM15 memory system from 16K to 24K or 24K to 32K (second or third 8K mounted on back door of CPU).	MM15-CB or equiv.	11,000	$ 50	125	Yes
16K Blocks						
MM15-EB	16K, 18-bit MM15 Memory Option. Expands MM15 memory system from 8K to 24K (contains one MM15-CB and one MM15-CC). Also implemented as first 16K core for use in MX15 option.	MM15-AB or MM15-AC + MM15-A or equiv.	20,000	100	200	Yes
MM15-EC	16K, 18-bit MM15 Memory Option. Expands MM15 memory system from 16K to 32K (contains two MM15-CC options). Also implemented as second 16K core addition to MX15 options.	MM15-EB or equiv.	20,000	100	200	Yes

I/O OPTIONS   SECTION II-D

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
CARD EQUIPMENT						
CR15-FA* CR15-FB*	Card Reader & Control (115V, 60Hz). Card Reader & Control (230V, 50Hz). 300 card/min. optical reader.	None	$ 5,000	$75	$240	No
CR15-DA* CR15-DB*	Card Reader & Control (115V, 60Hz). Card Reader & Control (230V, 50Hz). 1000 card/min. optical reader.	None	10,000	75	240	No
CR03-B*	Card Reader & Control. 200 cpm.	None	6,000	50	240	No
PAPER TAPE EQUIPMENT						
PC15	Paper Tape Reader/Punch. 300 char/sec. optical reader. 50 char/sec. punch.	BA15	3,900	30	320	Yes
LINE PRINTERS						
LP15-FA LP15-FB	Line Printer & Control (115V, 60Hz). Line Printer & Control (230V, 50Hz). 356 to 1110 lpm**, 80 columns, 64 character set.	None	14,000	60	200	No
LP15-HA LP15-HB	Line Printer & Control (115V, 60Hz). Line Printer & Control (230V, 50Hz). 253 to 843 lpm**, 80 columns, 96 character set.	None	15,500	65	200	No
LP15-JA LP15-JB	Line Printer & Control (115V, 60Hz). Line Printer & Control (230V, 50Hz). 245 to 1110 lpm**, 132 columns, 64 character set.	None	19,500	75	250	No
LP15-KA LP15-KB	Line Printer & Control (115V, 60Hz). Line Printer & Control (230V, 50Hz). 173 to 843 lpm**, 132 columns, 96 character set.	None	21,000	80	250	No
X Y PLOTTERS (CALCOMP)						
12" Drum Units (Model 565)*						
XY15-AA	Plotter and Control. 0.01-Inch Step, 18,000 Steps/Minute.	None	8,900	30	280	No
XY15-AB	Plotter and Control. 0.005-Inch Step, 18,000 Steps/Minute.	None	8,900	30	280	No
31" Drum Units (Model 563)*						
XY15-BA	Plotter and Control. 0.01-Inch Step, 12,000 Steps/Minute.	None	12,900	35	320	No
XY15-BB	Plotter and Control. 0.005-Inch Step, 18,000 Steps/Minute.	None	12,900	35	320	No
XY15	Control only. For both Model 563 and 565.	None	3,500	15	200	No

*Table top model; reads standard 80 column level punch cards.
**Minimum speed based upon printing all columns available. Printers operate at higher speeds when printing partial lines.
***Table Top Units.

MASS STORAGE SECTION II-E

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
ROTATING MEMORY OPTIONS						
RF15	DECdisk Control. Controls up to (8) RS09 DECdisk units. Includes cabinet which accommodates either (2) RS09 or (3) RS09 disks.	None	$ 6,000	$ 35	$220	Yes
RS09	DECdisk Unit. 262,144 18-bit words. Unit is word addressable. Three transfer rates, switch selectable: 62.5K words/sec., 31.23K words/sec. or 15.625K words/sec.	RF15	9,000	45	240	Yes
RP15-A RP15-B	Disk Pack Control (115V, 60Hz). Disk Pack Control (230V, 50Hz). Controls up to (8) RP02 Disk Pack Drives.	None	18,000	125	450	Yes
RP02-A RP02-B	Disk Pack Drive Unit (115V, 60Hz). Disk Pack Drive Unit (230V, 50Hz). 10.24 million 18-bit words/unit. Average access time 62.5 ms. Transfer rate 135K words/sec.	RP15	18,000	125	400	No
RP02P	Spare Disk Pack.	RP02	475	—	—	No
MAGNETIC TAPE						
DECTAPE						
TC15	DECtape Control. Controls up to (4) TU56 Dual DECtape Transports. Includes cabinet. Operates via multicycle Data Channel.	None	5,400	25	240	Yes
TU56	Dual DECtape Transport. Nominal transfer rate 5K words/sec. 375 BPI. 150K words/tape reel. 100% redundant recording for reliability. Random access read or write in either direction.	TC15	4,700	30	60	Yes
INDUSTRY-COMPATIBLE MAGNETIC TAPE						
TC59-D	Magnetic Tape Transport Control. Controls up to (8) TU10-E or TU10-F Magnetic Tape Transport Units. Will operate both 7 and 9 transports. Operates via multicycle data channel. Cabinet included.	KW15	6,950	35	400	Yes
TU10-FE TU10-FJ	Magnetic Tape Transport (115V, 60Hz). Magnetic Tape Transport (230V, 50Hz). 7-track, 45 ips magnetic tape. Transport; 200,556 and 800 bpi. Includes cabinet.	TC59D	6,950	70	400	No
TU10-EE TU10-EJ	Magnetic Tape Transport (115V, 60Hz). Magnetic Tape Transport (230V, 50Hz). 9-track, 45 ips, 800 bpi. Includes cabinet.	TC59D	6,950	70	400	No

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
DATA COMMUNICATIONS						
LT19-D	Multi-Station Teletype Control. Accommodates (but does not include) up to five LT19-E line units. Three LT19-D controls can be attached to PDP-15 systems. Maximum (combined unit) throughput rate: 30K baud. Includes cabinet.	DW15-A	$1,800	$10	$160	Yes
LT19-E	Teletype Line Unit. One required for each teletype or EIA line adapter. Separate transmit clock for each unit.	LT19-D	800	3	60	Yes
LT19-F	EIA Line Adapter. Adapts each LT19-E to EIA standard levels (Dataphone compatible).	LT19-D LT19-E	100	3	60	Yes
LT19-H	Cable Set. Connects an LT19-F either to another LT19-F or PT08-F for interprocessor communication.					
	LT19-HA 50 feet	LT19-F	60	—	—	Yes
	LT19-HB 100 feet	LT19-F	65	—	—	Yes
	LT19-HC 150 feet	LT19-F	70	—	—	Yes
	LT19-HD 200 feet	LT19-F	75	—	—	Yes
	LT19-HE 250 feet	LT19-F	80	—	—	Yes
LT15-A	Single Teletype Control. Interfaces a second teletype-like device to the PDP-15 in addition to the teletype. Used for Background/Foreground, RSX and Graphic-15 applications.	BA15	1,200	3	160	Yes
DP09-A	Data Communications System. Compatible with EIA RS232B. Interfaces PDP-15 to Bell System 201 or 301 data set. Full duplex mode. 2400 Baud, bit synchronous.	None	6,000	25	200	Yes
DC01-ED	Multi-Station Teletype Control. Separate transmit clock per channel. Includes 8 serial channels. Used in MUMPS configurations.	None	6,000	20	200	Yes

COMMUNICATIONS TERMINALS

110 BAUD UNITS

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
LT33-DC	ASR-33 Teletype (115V, 60Hz).					
LT33-DD	ASR-33 Teletype (230V, 50Hz). Automatic Send-Receive Unit with paper tape reader and punch, and model TU friction paper feed. Standard cable 12 feet.	*	1,500	30	120	No

*Requires LT15 or LT19 when used as other than a console device.

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
LT33-CC	KSR-33 Teletype (115V, 60Hz).					
LT33-CD	KSR-33 Teletype (230V, 50Hz). Teletype Model 33 keyboard send/ receive unit with friction paper feed. Standard cable 12 feet.	*	$1,200	$25	$80	No
LT35-DC	ASR-35 Teletype (115V, 60Hz).					
LT35-DD	ASR-35 Teletype (230V, 50Hz). Automatic send/receive unit with paper tape reader and punch and sprocket paper feed. Standard cable 12 feet.	*	4,500	25	150	No
LT35-CC	KSR-35 Teletype (115V, 60Hz).					
LT35-CD	KSR-35 Teletype (230V, 50 Hz). . Teletype model 35 keyboard send/receive unit with sprocket paper feed. Standard cable 12 feet.	*	3,000	22	80	No

300 BAUD UNITS

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
LA30-CA	DECwriter DATA Terminal (115V, 60Hz).					
LA30-CD	DECwriter Data Terminal (230V, 50Hz). Serial input/output device. Switch selectable baud rates of 110, 150 and 300. Prints 80 char. lines at six lines/inch on 9-7/8″ wide continuous form original +1 copy. Data entry: USACII-1968. Includes serial interface. Standard cable 12 feet.	*	3,195	30	100	Yes

2400 BAUD UNITS

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
VT05	Alphanumeric Video Display Terminal. Cathode Ray Tube display with keyboard. Half or full duplex. Displays 20 lines of 72 char. on 8-3/4″ x 6-3/8″ screen. Teletype compatible at rates up to 2400 baud. 25 ft TTY loop 20 mA cable included.	*	2,795	22	80	Yes

Suffixes should be specified as follows.

VT05A-——110, 150, 300 baud
VT05B-——110, 150, 300, 600, 1200,
          2400 baud
      A— no parity, 64 character
          keyboard
      B— no parity, 96 character
          keyboard
     —A 115V, 60Hz
     —D 230V, 50Hz

For example, a model VT05A-BD operates between 110 and 2400 baud. It has no parity check, a 96 character keyboard, and operates on a 230V, 50Hz power supply.

*Requires LT15 or LT19 when used as other than a console device.

GRAPHICS AND DISPLAYS SECTION II-G

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status

DISPLAYS (POINT PLOTTING UNITS)

STORAGE DISPLAYS

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
VP15-A	Storage Tube Display and Control. 10-bit data word per direction (one part in 1024 resolution). Storage and non-storage modes under program control. Erase is push button or program controlled. Table top unit is 5-1/4″ x 6-3/8″. Includes VT01-A display with 15 ft. cable.	BA15	$ 5,800	$86	$200	$3,000 Not disc.
VT01-A	Storage Tube Display only. Rack mountable; includes 15 ft. cable.		3,000	75	60	No

REFRESH DISPLAYS

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
VP15-B	Oscilloscope and Control. 5″ diameter. 10-bit data word per direction (one part in 1024 resolution). Plotting rate 12 μsec/point. Rack mounted.	BA15	3,600	30	70	800 Not disc.
VP15-BL	Oscilloscope and Control with Light Pen. Same as VP15-B but works in conjunction with light pen.	BA15	5,225	35	150	800 Not disc.
VP15-C	Oscilloscope and Control—7″ x 9″ VR14 X-Y display system with 10-bit data word per direction (one part in 1024 resolution). Rack mounted.	BA15	5,800	44	200	Yes
VP15-CL	Oscilloscope and Control with Light Pen. Same as VP15-C with light pen.	BA15	7,425	49	300	Yes
VP15-D	Two Color Oscilloscope and Control. Red/Green 7″ x 9″ X-Y display system with 10-bit data word per direction (one part in 1024 resolution). Programmable color change. Rack mounted.	BA15	7,000	50	220	Yes
VR01-A	Oscilloscope only. 5″ diameter display screen. P7 phosphor standard.	None	1,000	14	90	No
VR14 VR14-A	Oscilloscope only (115V.). Oscilloscope only (230V.). 7″ x 9″ display screen. P31 phosphor standard.	None	3,000	19	100	Yes
VR20 VR20-A	Two Color Oscilloscope only (115V.). Two Color Oscilloscope only (230V.). Red/Green 7″ x 9″ X-Y Display.	None	4,000	22	100	Yes

INTERACTIVE GRAPHICS

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
GT15-SA GT15-SB	Graphic Terminal (115V, 60Hz). Graphic Terminal (230V, 50Hz). Interactive graphic station with 17″ (diagonal) display including VT15, VT04, VV15 and VL04.	PDP-15	24,000	138	1,028	4500 Not disc.

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Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Status Discount
GT15-LA GR15-LB	Graphic Terminal (115V, 60Hz). Graphic Terminal (230V, 50Hz). Interactive graphic station with 21″ (diagonal) display including VT15, VT07, VV15 and VL07.	PDP-15	$29,000	$163	$1,125	$10,000 Not disc.
VT15-A	Graphic Display Processor. Read only memory high speed ASCII character generator. Eight direction vector generator. Optional: light pen, writing tablet, keyboard, arbitrary vector generator, slave display multiplexer. Includes cab and indicator panel.	PDP-15	14,400	86	500	Yes
VT04-A VT04-B	Graphic Display Console (115V, 60Hz). Graphic Display Console (230V, 50Hz). Display console with 17″ diagonal CRT (9-1/4″ x 9-1/4″ major drawing area, 1-1/4″ x 9-1/4″ menu area). 6 lighted function buttons. Houses LK35 option. Std VT04/VT15 cable: 25 ft.	VT15	4,500	25	250	No
VT07-A VT07-B	Graphic Display Console (115V, 60Hz). Graphic Display Console (230V, 50Hz). Display console with 21″ diagonal CRT (12″ x 12″ major drawing area, 2″ x 12″ menu area). 6 lighted function pushbuttons. Accommodates LK37 option. Std VT07/VT15 cable: 25 ft.	VT15	10,000	50	350	No
VV15	Arbitrary Vector Generator. Permits drawing of stroke vectors in any direction via hardware.	VT15	5,000	20	200	Yes
VM15	Display Multiplexer. Controls up to 4 VT04's.	VT15	5,000*	20	200	Yes
LK35	Keyboard. Remote electronic keyboard for VT04. Mounts in VT04 console.	VT04 plus LT15-A or LT19-D plus LT19-E	1,200	30	120	No
LK37	Keyboard. Free standing remote electronic keyboard for use with VT07 console. LK37/VT07 cable: 6 feet.	VT07 plus LT15-A or LT19-D plus LT19-E	1,200	30	120	No
VL04	Light Pen. Interacts with refresh type display.	VT04	700	7	75	Yes
VL07	Light Pen. Interacts with VT07 display console.	VT07	700	7	75	Yes
VW01-BP	Writing Tablet and Control. Includes Spark Pen and 11″ x 11″ writing tablet. 10-bit data word per direction (one part in 1024 resolution).	None	3,500	30	200	No

*Each VT04 or VT07 console unit is supplied with a standard 25 foot cable. Other cable lengths available at $150 each plus $1.50 per foot length.

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
VW01-MX	Writing Tablet Multiplexer. Accommodates up to three additional VW01-MA writing tablets.	VW01-BP	$1,000	$ 5	$75	No
VW01-MA	Writing Tablet and Spark Pen. Additional 11″ x 11″ writing tablet with VW01-SP spark pen. Includes component box.	VW01-MX	2,000	10	75	No
VW01-SP	Spark Pen. Replacement spark pen only.	None	200	10	75	No
VW01-WT	Writing Tablet. Replacement 11″ x 11″ writing tablet only.	None	800	10	75	No

INDUSTRIAL CONTROL OPTIONS SECTION II-H

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
CENTRAL CONTROL UNIT						
BD15-A	Central Control Unit 115V.					
BD15-B	Central Control Unit 230V. Controls up to (11) AFC15 options (2048 analog channels) and (11) UDC15 options (4096 digital points in 16-bit I/O words). Includes cabinet.	None	$7,500	$50	$400	No
ANALOG FLYING CAPACITOR SYSTEM						
AFC15-A	Analog Input Scanner 115V.					
AFC15-B	Analog Input Scanner 230V. Basic unit consists of cabinet, one AM07-A system unit which can accommodate up to 32 channels and contains a switched gain amplifier. Accommodates up to (5) AM07-B's of 32 channels each, to provide a maximum of 192 channels. Allows sampling of 200 channels/second and 20 samples/second on the same channel using a 12-bit converter (11 bits + sign) and a switched gain amplifier (max. gain of 1000). AFC15 scanner is the "flying capacitor" type.	BD15	5,000	25	75	No
AM07-B	Expander Unit. Each unit can accommodate a maximum of 32 channels.	AFC15	300	3	30	No
BA150	Multiplexer Module. Eight channel flying capacitor multiplexer. One required for each 8-channel group.	AFC15 or AM07-B	300	4	40	No
BA903	Direct Signal Module. Input range: 0 to 10 volts. One required for each 8-channel group.	BA150	40	4	40	No
BA904	Voltage Conditioning Module. Input signal 0 to 100 volts. 10:1 voltage conditioning. One required for each 8-channel group.	BA150	150	4	40	No
BA905	Current Conditioning Module. Current input 0 to 50 mA. One required for each 9 channel group.	BA150	80	4	40	No
BC90C-4	Cable and Screw Terminal Assembly. One required for every two BA150 modules.	BA903 or BA904 or BA905	80	—	—	

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status

UNIVERSAL DIGITAL CONTROL SYSTEM

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
UDC15	Digital Input/Output Controller. Basic unit consists of cabinet, one DD02 system unit (unit does not include I/O word or power modules and screw terminal assembly) and provision for the mounting of five additional DD02's. Provides for maximum of 24 16-bit I/O words (total of 384 digital points).	BD15	$2,800	$20	$60	No
DD02	System Unit. Each unit can accommodate four 16-bit I/O words (64 digital points).	UDC15	300	2	20	No

Combination and quantity of the following options depend entirely upon specific UDC15 applications. All options relate to 16-bit I/O words.

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
BM685	Flip-Flop Driver Module.	UDC15 & DD02	155	1	4	No
BM687	Single-Shot Driver Module.	UDC15 & DD02	310	2	8	No
BW731	Contact Sense Module.	UDC15 & DD02	155	1	4	No
BW733	Contact Interrupt Module.	UDC15 & DD02	360	2	9	No
BM803	Latching Relay Module.	UDC15 & DD02	610	2	15	No
BM805	Flip-Flop Relay Module.	UDC15 & DD02	530	2	12	No
BM807	Single-Shot Relay Module.	UDC15 & DD02	630	2	15	No
BW400	Isolated Power Card Module.	BW731 or BW733 BM803 BM805 BM807	25	N/A	N/A	No
BW402	Common Power Card Module.	BM731 or BM733 BM803 BM805 BM807	25	N/A	N/A	No
BW403	Relay Power Card Module.	BM685 or BM687	25	N/A	N/A	No
BC40C	Cable and Screw Terminal Assembly. One required for each I/O word.	None	60	N/A	N/A	No

LABORATORY EQUIPMENT SECTION II-I

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
NUCLEAR PHYSICS						
PULSE HEIGHT ANALYSIS						
NP15	Nuclear Physics Assembly. Includes NP02-LA list mode PHA interface, 841B/828 power supply control, CSS/716 indicator panel and power supply and H960-A cabinet. Implements 1 or 2 customer furnished ADC's and a "live-time" clock.	None	$5,900	$30	$300	No
CAMAC						
CA15-A	CAMAC Interface. Branch driver for up to 7 CAMAC crates, includes Indicator Panel, Cabinet and Power Supply. Operates under program control or via 3 cycle data channel. Communicates with customer furnished CAMAC Type A Crate controller.	None	9,950	75	900	No
LABORATORY DATA ACQUISITION EQUIPMENT						
ANALOG-TO-DIGITAL—MEDIUM SPEED						
AD15	A/D Converter. Medium speed, three-cycle data channel device. Includes interface and control, ADC, S/H programmable gain amplifier with full scale of $\pm$ 10.0V, one AM01-A and one BA124. Provides expandability to 128 channel capability by implementation of 3 additional AM01-A units. 30 kHz max. conversion rate (12 bit + sign) with 22 kHz throughput.	None	6,000	25	350	Yes
AM01-A	Expander Unit. Permits AD15 expansion in 32-channel blocks. One required for each 32 channel group. AM01-A for first 32 channels is supplied with AD15. Up to 3 additional AM01-A units may be implemented. Each accommodates (8) BA124 modules.	AD15	500	5	75	Yes
BA124	Analog Multiplexer Switch. Four channel MOS FET switch module, one required for each 4-channel group.	AD15	65	2	8	Yes

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Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
ANALOG-TO-DIGITAL—HIGH SPEED						
ADF15-CA	High Speed A/D Converter (115V).					
ADF15-CB	High Speed A/D Converter (230V). 100 kHz throughput rate; 0-36 analog channel capability wired in 32-channel groups. Wiring for first 32 channels included.* Six operating modes. Otherwise similar to AD15.	None	$ 9,000	$ 30	$ 200	Yes
DIGITAL-TO-ANALOG						
AA15-A	D/A Multiplexer Control. Accommodates up to sixteen AAC2 12-bit D/A channels.	None	4,500	7	350	Yes
AAC2	D/A Converter. Digital-to-Analog, single buffered, 0 to ± 10V.	AA15	350	6	**	Yes
DIGITAL VOLTMETER						
AF04-B	Integrating Digital Voltmeter. Analog input subsystem with Multiplex control for 10-1000 3-wire high or low level differential analog inputs (± 10mV to ± 300V full scale ranges with programmable range and autoranging). Includes panel for 200 channels. Rack mounted.	None	20,000	120	1,050	No
AF04-X	Expansion Mounting Panel. Expands AF04-B system by 200 channels. Up to 4 additional 200 channel groups may be added to AF04-B. Each accommodates 20 AF04-S options.	AF04B	1,800	6	60	No
AF04-S	Multiplexer Switch Module. 10 channel guarded-reed relay switch. Low level.	AF04-B	330	3	40	No

*For AD15 systems configured for implementing 64 or 96 channels of analog input, add $1500 or $3000 respectively to the basic ADF15 price.

Note—Each system application of the ADF15 will be configured and priced by the Data Acquisition Control System (DACS) group.

**$50 each for first two channels, $10 each for additional channels.

ACCESSORIES SECTION II-J

Option Number	Description	Hardware Prerequisite	Price	1-Shift Service	Field Install.	Discount Status
CABINETS						
H960-A	Free standing cabinet. Includes filter, fan, casters, levelers, rear mounting panel door, door cover, end panels, and 63 inch open front. (See Module Products price list for front panel options.)	None	$ 650	$—	$—	Yes
H961-A	H960-A without end panels.	None	430	—	—	Yes
TABLES						
H954-G	Table. Formica top specially designed to attach to VT04 Graphic Display console. Provides 21-inch long work surface each side of console; overall dimensions: 17 inches wide by 60 inches long by 26 inches high.	None	120	—	—	
I/O CABLES*						
BC09B-02	2 foot		204			Yes
BC09B-03	3 foot		206			Yes
BC09B-04	4 foot		208			Yes
BC09B-05	5 foot		210			Yes
BC09B-07	7 foot		216			Yes
BC09B-10	10 foot		220			Yes
BC09B-12	12 foot		224			Yes
BC09B-15	15 foot		230			Yes
BC09B-25	25 foot		250			Yes
BC09B-50	50 foot		300			Yes
BC09B-A0	100 foot		350			Yes
KITS (SOFTWARE)						
SK15-A	For PDP-15/20/30/40 Systems. Contains 18 certified DECtapes, 1 DECtape carrying case, 250 blue DECtape tabs, 2 teletype ribbons, 2 boxes of formfeed teletype paper, 1 case of fanfold paper tape, 4 paper tape plastic storage trays.	None	400	—	—	No
SK15-B	For PDP-15/10 Systems. Contains 2 teletype ribbons, 2 boxes of rolled, non-perforated teletype paper, 1 case of fanfold paper tape, 6 paper tape plastic storage trays.	None	80	—	—	No
KITS (SPARE PARTS)						
SP15-A	Spare Parts Kit for PDP-15/10		3,907	+ tools		No
SP15-B	Spare Parts Kit for PDP-15/20		7,423	+ tools		No
SP15-C	Spare Parts Kit for PDP-15/30		9,090	+ tools		No
SP15-D	Spare Parts Kit for PDP-15/35 and PDP-15/40		11,370	+ tools		No

*All cables are 36-pair conductors with M912 connectors at either end.

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SECTION III – SOFTWARE PRICING

NO CHARGE SOFTWARE

Digital Equipment Corporation supplies certain software at no charge to customers who purchase appropriate hardware. All standard hardware, for example, is supplied with diagnostic programs, tapes, and the documentation required for its installation and maintenance.

Also available at no charge are the following monitor software packages. For paper tape systems, Basic Monitor Software is available. DECtape systems use the Advanced Monitor Software and DOS-15, the Disk Operating System, is available for systems with the appropriate disk hardware.

SOFTWARE FOR PURCHASE

Customers who have purchased appropriate hardware* from DIGITAL may purchase the following software systems. This software includes the documentation and services described in the Software Warranty Policy.

Software	Option Number	Price
RSX PLUS	RSX15-B	$5,000
BOSS-15	BOS15-A	2,500
GRAPHICS/RSX	RGX15-A	1,500 (RSX PLUS also required)
RASP-15	RSP15-A	1,000 (RSX PLUS also required)
ALGOL compiler	AGL15-A	1,000

Customers purchasing software must observe DIGITAL's standard licensing agreement restricting the use, reproduction or redistribution of the software.

* See Section I.

SOFTWARE WARRANTY POLICY

The following documentation and services are supplied with systems software.

1. Binary coded copies of the software on the appropriate kind of tape (paper tape, DECtape or magnetic tape).
2. Source coded copies of the software on DECtape. (ADSS and DOS source programs are available from Program Library at $35/DECtape.)
3. Manuals covering the operation and use of each major software subgroup.
4. Documentation covering details of checkout and acceptance. Also any corrections such as minor patches to the software.

5. Installation and checkout at customer's site.
6. Appropriate software training courses, site and time to be specified by DIGITAL.
7. The following table lists the number of days of support and training available with the various software systems. Support must be performed during the system's warranty period.

Software Product	Option Number	Remedial Support (days)	Installation and Advisory Support (days)	Free Training
Advanced Software	ADS15-A	180	2	10 days, 1 person*
DOS-15	DOS15-A	180	3	10 days, 1 person*
BOSS-15	BOS15-A	180	6	5 days, 1 person
RSX PLUS	RSX15-B	180	10	5 days, 2 persons
RASP	RSP15-A	180	2	2 days, 1 person
RSX/GRAPHICS	RGX15-A	180	3	2 days, 1 person
ALGOL	AGL15-A	180	1	—

* With purchase of PDP-15 System.

Installation Support
Installation Support includes on-site assistance in configuring and loading the operating system—a function which normally takes one to two days. Both the operator and maintenance personnel should be present during that time.

Advisory Support
Advisory Support helps the customer get his system into operation with maximum efficiency and minimum delay. Through technical counseling and familiarization with DIGITAL products and services, the customer is better equipped to take full advantage of system resources.

Remedial Support
DIGITAL provides the customer with continuing remedial support on standard software products. This service takes two forms, depending on the seriousness of the difficulty.

The *Software Performance Report (SPR) Service* is designed to handle software deficiencies that do not interfere with the system's primary functions. To bring attention to the difficulty, the customer fills in an SPR form and sends it to the local software specialist. Response will be provided by DIGITAL's SPR service. SPR forms are included in the software kit with the system or can be obtained from the customer's software support specialist.

The *Telephone Inquiry Service* provides response for difficulties that prevent a system from fulfilling its primary function. Here the specialist undertakes to provide a solution by phone, verifying the difficulty and attempting to solve the problem or find a suitable alternative.

SUPPORT AVAILABLE AT EXTRA COST

Resident Software Support

A resident software specialist for the PDP-15 may be hired at a rate of $3,130 per month for a minimum period of six months. A resident software specialist not only helps during installation and routine operation but is also available for on-the-job training of the customer's personnel. Such a specialist is particularly valuable in highly demanding production environments.

Contract Consulting

Software consulting services are available at a rate of $28 per hour plus expenses.

For example, a contract of one 8-hour day per week for a 3-month period would be less than $3,000 excluding expenses. To receive this hourly rate, the customer must contract for between one and eleven days per month for a minimum period of three months. In contract consulting, the customer is billed on a monthly basis whether or not he has used the full extent of the contracted services.

On Call Consulting

Non-scheduled quick response consulting or longer term consulting is also available at a rate of $33 per hour plus expenses. Customers are billed on a monthly basis for the actual expenses incurred.

SECTION IV – HARDWARE MAINTENANCE

A computer, like any other complex piece of machinery, needs continuing preventive maintenance to keep it in top operating condition. To assure that service will be available, DIGITAL's expanding field service organization is comprised of over 1,000 engineers in some 100 offices throughout the world. And, the staff is thoroughly trained and highly experienced . . . many have over 8 years experience in computer systems.

DIGITAL also recognizes customer needs by providing flexible service arrangements. The customer can select on-call service during the shifts that the system is in full operation. He can hire an on-site engineer for full time service where requirements are critical. He can buy service on an individual service call basis. Or, if he has the facilities and staff, he can train his own maintenance crew to service the computer system and maintain its own spare parts inventory.

By selecting from these coverages, the customer can tailor service to the operating requirements of the system, keeping costs down, yet assuring smooth continuous operation.

SERVICE DISCOUNT PLANS

The following two plans can significantly lower the maintenance prices quoted in the previous table.

5% Prepayment Discount

By paying the annual service charge in advance (12 times the monthly rate), the customer is eligible to receive a 5 percent prepayment discount.

8% Special Introductory Offer (S.I.O.) Discount

If a customer elects to purchase a one-year service agreement at the time he purchases his system and includes the service agreement on his purchase order, he can receive an 8% discount from the standard list price.

This discount applies only to the first year of the service agreement (full year agreements only) and does not apply to add-on equipment for existing systems.

A customer can receive both the Special Introductory Offer Discount and the annual prepayment discount. The S.I.O. discount is calculated first, then the prepayment discount applied to the net S.I.O. charge.

For a 15/75 system, for example, a one-year service contract is $4,200, total of the discounts is $529.20, leaving a net charge of $3,670.80.

SHIFT AND MULTI-SHIFT COVERAGE

The following table shows monthly rates for various PDP-15 systems for 8-hour, 12-hour, and 16-hour contracts. Rates include both parts and labor. Extended coverage is also available for all standard system hardware.

System	*Monthly Charge for Service Contract*		
	8 hours	*12 hours*	*16 hours*
PDP-15/10	$200	$226	$252
PDP-15/20	330	373	416
PDP-15/30	480	542	605
PDP-15/40	630	712	794
PDP-15/50	648	732	816
PDP-15/73	300	339	378
PDP-15/75	350	396	441
PDP-15/77	550	622	693
PDP-15/79	730	810	898

SECTION V – TRAINING COURSES

DIGITAL offers training credits with most systems purchased (OEM and discounts excepted). These credits may be used for tuition in standard hardware or software courses and are valid for nine months from the date of order.

Training credits for PDP-15 systems are shown in the following table. One credit equals one man-week of training and may be used for either hardware or software training.

System	Credits
PDP-15/10	4
PDP-15/10 with 8K of MK15-A Memory and PC15 Reader/Punch	5
PDP-15/20	5
PDP-15/35	5
PDP-15/30/40	6
PDP-15/50	8
PDP-15/73	5
PDP-15/75	5
PDP-15/77	6
PDP-15/79	8

PDP-15 TRAINING COURSES

Title	Length (days)	Price	Credits
PDP-15 Systems Software	10	$540	2
BOSS 15 & FORTRAN IV	5	325	1
Graphic-15 Software	5	325	1
RSX-PLUS	5	325	1
MUMPS-15	5	325	1
PDP-15 Hardware	15	700	3
DOS I/O Handlers	2	135	—

The following descriptions outline the PDP-15 courses available. See the Educational Catalog schedule for convening dates.

PDP-15 SYSTEMS SOFTWARE

Upon completion of this course, a student will be able to:

1. Write, re-write and read an assembly language program using the PDP-15 instruction set and MACRO assembler syntax.
2. Interface his programs to the Advanced (ADSS) or DOS I/O Monitor.
3. Operate and execute the following system programs: MACRO, EDIT, LINKING LOADER, PIP, DUMP, PATCH and UPDATE.

Length: 10 days

Price: 2 training credits or $540

Prerequisites: The student should be familiar with assembly language programming, assemblers, editors and operating systems. Formal training in assembly language can be obtained by attending the INTRODUCTORY PROGRAMMING course. It should be noted, however, that this course meets only part of the prerequisites.

Content: The course contains discussions of the PDP-15 basic instruction set, indexing features, memory modes, interrupt systems, MACRO assembler syntax, and basic system architecture and operation. It also familiarizes the student with file structures for DECtape and disk, library structure, the I/O monitor's operational features, basic monitor I/O calls, the writing of I/O handlers for disk, advanced monitor, operating systems, and the following system programs: EDIT (a general text editor); LINKING LOADER (a relocatable and library routine loader); UPDATE (library management utility); PIP (peripheral interchange program); DUMP (mass-storage octal dump utility); PATCH (on-line modification to system programs and mass-storage devices); DDT (dynamic program debugging routine) and SGEN (system software configurator). Approximately 35% of course time is allotted to supervised laboratory sessions.

BOSS-15 AND FORTRAN IV

The intent of the course is to give a system programmer enough knowledge about BOSS-15 and PDP-15 FORTRAN to set up and manage a PDP-15 Batch installation.

Length: 5 days

Price: 1 training credit or $325

Prerequisites: The student must be thoroughly familiar with the PDP-15's operation, instruction set, system programming, and the following PDP-15 system programs: EDIT, MACRO, UPDATE, PATCH, DDT, LINKING LOADER and DUMP. Formal training can be obtained by attending the PDP-15 SYSTEM SOFTWARE course.

Content: The course contains a review of the FORTRAN-IV language, operation of the FORTRAN compiler, writing new FORTRAN functions and special FORTRAN additions. It also covers the Batch Operating System operation and how to specify new input card parameters (writing procedure files). Approximately 20% of the course time will be allotted to supervised laboratory sessions.

GRAPHIC-15 SOFTWARE

Upon completion of this course, the student will be able to write display file programs which are inter-active with a PDP-15 routine.

Length: 5 days

Price: 1 training credit or $325

Prerequisites: The student must be thoroughly familiar with the DOS or ADSS oper-ating systems and the PDP-15 instruction set as provided by the PDP-15 SYSTEMS SOFTWARE course.

Content: The course presents an overview of the GRAPHIC-15's operation and in-struction set. It also covers the follow-ing concepts and subsystems: VTA (GRAPHIC-15 I/O driver for ADSS and DOS operating systems); VTPRIM (FORTRAN library routines for DOS and ADSS operating systems); and display file interaction with the PDP-15's central processor. Approxi-mately 30% of the course time is allotted to supervised laboratory sessions.

RSX-15 PLUS

This course will enable the student to:

1. Write and schedule USER or EXECUTIVE mode tasks.

2. Write RSX device driver tasks.

3. Configure and operate a real-time multi-program system.

Length: 5 days

Price: 1 training credit or $325

Prerequisites: The student must be thoroughly familiar with the PDP-15 instruction set, Text Editor, MACRO assembler syntax, Automatic Priority Interrupt system, CAL handler routines, index-ing and the PDP-15 system architec-ture. Formal training in this area can be obtained by attending the PDP-15 SYSTEMS SOFTWARE course.

Content: The course discusses the conceptual operation of the RSX system, Monitor console routine, I/O driver tasks, I/O calls, executive level directives and task scheduling. The system architec-ture is analyzed by referencing the RSX-15 assembly listing, which in-cludes: RSX Real Time Clock, Proces-sor, SCOM and system subroutines, Significant Event Processor and the CAL dispatcher. The following pro-grams will be discussed and executed in a supervised laboratory session: TASK BUILDER, SYSTEM CONFIGU-RATOR, DISK RESTORER and DECTAPE SAVE.

MUMPS-15 FOR DATA MANAGEMENT

The course will enable the student to make efficient use of the MUMPS language to manipulate arithmetic and string data in a large data base.

Length: 5 days

Price: 1 training credit or $325

Prerequisites: None

Content: The course covers the MUMPS language, the utility package, an overview of the system architecture, and detailed operating instructions on how to configure and run the system. Ample "hand-on" time is provided.

PDP-15 HARDWARE

This course gives the student instruction in the theory of operation of the PDP-15/20 programmed data processor, the KE15 Extended Arithmetic Element, and the TC15 DECtape controller.

Length:	15 days
Price:	3 training credits or $700
Prerequisites:	The student must be thoroughly familiar with basic machine language programming, octal and binary number systems, and fundamental computer philosophy. Training in these areas can be obtained from the INTRODUCTORY PROGRAMMING course. In addition, the student must be well versed in fundamental Boolean logic and equivalent electronic logic circuits.
Content:	The course covers the PDP-15 instruction set and the operation of the central processor, memory, I/O processor, Extended Arithmetic Element, DECtape controller, the system bus, control console, high speed reader and punch interface, console teletype interface, and data channel facility.

WRITING DOS-15 I/O HANDLERS (SEMINAR)

This seminar will enable a student to write a device handler for his system.

|	
Length:	2 days
Cost:	$135
Prerequisites:	A thorough knowledge of PDP-15 assembly language programming.
Content:	The course includes much of the same I/O handler information as the PDP-15 SYSTEMS SOFTWARE course. The course covers in detail the interrupt section (API and PIO), and CAL handling section. Approximately 50% of the course will be allotted to discussing an actual I/O handler.

ON SITE EDUCATIONAL SERVICE

Digital offers to its PDP-15 customers a well-established education program that is designed specifically to be given at a customer's installation in order to satisfy his particular needs and schedule. These courses are taught by DIGITAL's full-time professional educational staff, the same staff that conducts regularly scheduled courses at DIGITAL education centers throughout the world.

	Price*
PDP-15 INTRODUCTORY PROGRAMMING (1 week)	$2000
PDP-15 SYSTEMS SOFTWARE (2 weeks)	3500
RSX-15 SOFTWARE (1 week)	2000
MUMPS-15 FOR DATA MANAGEMENT (1 week)	2000
GRAPHIC-15 (1 week)	2000
FORTRAN IV (3 days)	2000
PDP-15 HARDWARE FAMILIARIZATION (3 weeks)	5000
PDP-15 INTERFACING (3 days)	2000
PDP-15 INTERNAL OPTIONS MAINTENANCE (1 week)	2000
PDP-15 INTERNAL ADJUSTMENTS AND TROUBLE SHOOTING (1 week)	2000
GRAPHIC-15 DISPLAY PROCESSOR MAINTENANCE "VT15, VT04 or VT07" (2 weeks)	3500
TC59, TU10, TU20 MAGTAPE MAINTENANCE (2 weeks)	3500
RF09/15, RS09 DECDISK MAINTENANCE (2 weeks)	3500
RP15/RP02 DISK PACK MAINTENANCE (3 weeks)	5000
LP15-F LINE PRINTER MAINTENANCE (1 week)	2000
CR03 CARD READER MAINTENANCE (1 week)	2000

*Price covers up to ten students and includes all necessary course materials and instructor expenses.

SPECIAL COURSES AND SEMINARS

Digital offers special courses and/or seminars to solve the majority of your systems educational problems. These courses or seminars can be tailored to your needs and time schedule. For pricing and scheduling information contact: Digital Equipment Corporation
PDP-15 Training Manager
146 Main Street
Maynard, Massachusetts 01754
(617) 897-5111 x 2534
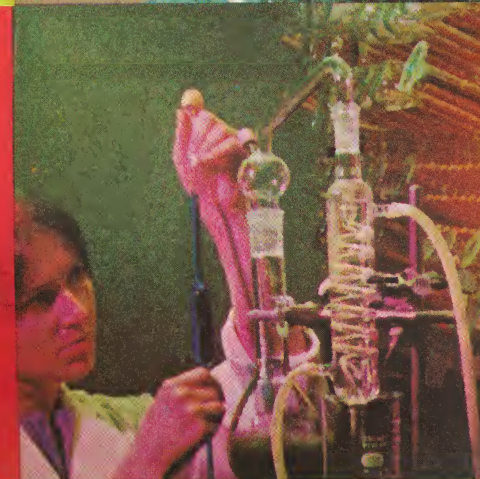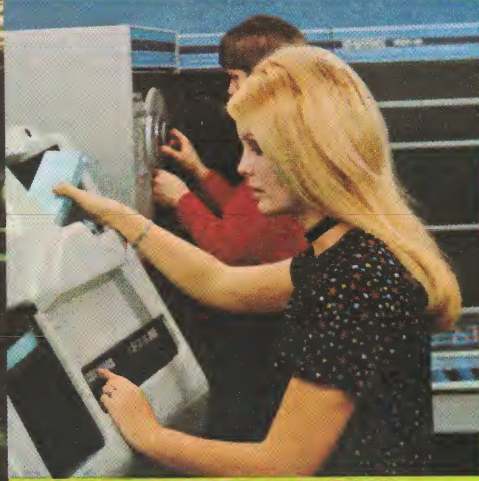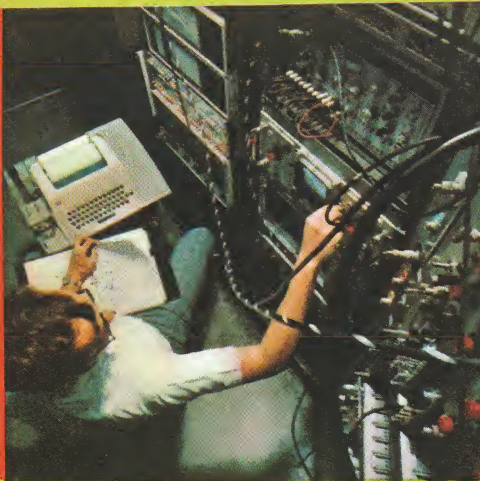
DIGITAL EQUIPMENT CORPORATION

pdp11

Option Bulletin

DX11B–PDP-11 TO IBM 360/370 CHANNEL INTERFACE

digital

FEATURES
- Interfaces to most models of the IBM 360 or 370 on the selector, multiplexer or block multiplexer channels
- Recognizes up to 128 IBM device addresses over the full range of 256 addresses.
- Operates in the byte multiplexed or burst mode
- NPR (DMA) operations to present status to 360, store 360 commands in the PDP-11, and transfer data
- Hardware recognition and presentation of the 360 device address plus hardware presentation of initial status
- Software interpretation and response to 360 commands
- Can be programmed to emulate a 2848, 2703 or 3705 control unit
- In off-line or powered-down mode, the DX11B is transparent to the S/360 and presents no load to the channel data and tag lines
- Built-in maintenance and protection features
- 250,000 byte/second data transfer rate (depending upon IBM model)

DESCRIPTION
The DX11B is a programmable interface between a PDP-11 UNIBUS™ and a S/360 or S/370 multiplexer or selector channel. The DX11B hardware handles the detection and response to all channel generated control signals. The DX11B hardware handles the Initial Selection Sequence operation without program intervention. It recognizes a wired (strapped) set of addresses, presents address, fetches a unique status (determined by the 360/370 command and device address) from a table in memory and stores an entry in a 128 entry tumble table. The status and tumble operations are by NPR (DMA). The tumble table entry contains status, IBM command and IBM address. Software interprets the command and responds to it. The commands recognized and the manner of response will depend upon the 360/370 control unit being emulated.

As soon as the hardware has stored the tumble table entry, it is ready to service another request from the 360/370. If both the PDP-11 and the 360/370 channel contend for the DX11B, the 360/370 channel wins and the PDP-11 is locked out. This protection feature makes sure the 360/370 channel is always master. It can cancel a previous request at any time.

The PDP-11 program loads DX11B registers to cause data transfers. Data transfer is by NPR. The length in bytes can be short (multiplex mode) or long (burst mode). Software determines which mode will be used. Burst mode is on selector channel or selector subchannel only.

The DX11B can be taken off-line or powered down. In either case, a relay closes to by-pass the SELECT-OUT line. The drivers and receivers on the 360/370 control and data lines present no bus loads when the DX11B is powered down. Thus, the DX11B is logically disengaged from the channel in the power-down or off-line mode. The DX11B contains power failure and timeout features. The power failure protection hardware interrupts the DX11 when an AC-low is detected. When in burst mode, timeout hardware interrupts the DX11 if the PDP-11 fails to respond in 5 seconds. In either case, the DX11B hardware stops all data transfers, presents UNIT CHECK status to the 360/370 and goes off-line. The programmer can disable the timeout feature during program debugging. The timeout will occur only while one of the DX11B-recognized devices is active (OPERATIONAL-IN is high).

The DX11B has a built-in channel simulator which is used by off-line diagnostics to verify the PDP-11 configuration up to and including the IBM cables. The latter can be checked by plugging one end into the DX11B and the other into the simulator.

Because NPR is used for data transfers, the DX11B is capable of data transfer rates in excess of 250,000 bytes/second. It is limited by the PDP-11 configuration and the rated capacity of the 360/370 channel to which it is attached.

PROGRAMMING

Programming Interfaces

Registers
The DX11B has the following set of programmable registers:

Address	Description
176200	Device Status (DXDS)
176202	Command and Address (DXCA)
176204	Control Unit Status (DXCS)
176206	Offset and Status (DXOS)
176210	Bus Address for NPR (DXBA)
176212	Byte Count for NPR (DXBC)
176214	Maintenance-Out (DXMO)
176216	Maintenance-In (DXMI)
176220	Control Bits (DXCB)
176222	NPR Data (DXND)
176224	Extra Signals (DXES1)
176226	Maintenance-Out Buffered (DXMOB)
176230	Extra Signals (DXES2)

REGISTERS

DXDS   DEVICE STATUS

This register contains all of the interrupt producing conditions along with various non-interrupt producing device status flags. This register is read only and is stored as the first tumble table entry before being reset.

DEVICE STATUS REGISTER

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

PARITY ERRORS
IBM RESET INDICATORS
CHANNEL STATUS FLAGS
CHANNEL-INITIATED END INDICATOR
CONTROL UNIT-INITIATED END INDICATORS
SPECIAL INDICATORS
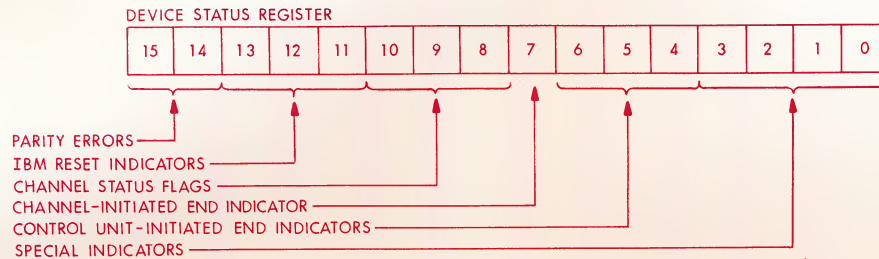
BITS

Error Indicators

15   PARER   Parity Error

This bit is set if the DX11B detects an even-parity condition on the BUSOUT when either command or data information is sent by the channel (CH) to the DX11B. PARER will be set if bad Command-Out parity is detected during an ISS or if bad (BUSO) Data-Out parity is detected. PARER is not set on bad Address-Out parity during an ISS. In this case the DX11B will not recognize the Address from the CH.

14   NXM   PDP-11 Bus Timeout

This bit will set should the PDP-11 take longer than $20\mu s$ to complete any one Non-Processor Request Transaction (NPR). Such an occurrence might be the result of addressing a non-existent (memory) location. If set during a data transfer, this will terminate the sequence by setting CUDEND. Bus timeout is taken as equivalent to bus completion elsewhere so that a sequence may proceed to its normal ending point.

IBM Reset Indicators

13   SELRST   Selective Reset

This bit will be set by the channel execution of a Selective Reset Sequence as described in the *Channel (CH) to Control Unit (CU) OEM interface manual* published by IBM. This sequence is usually a response to a malfunction CU/device. When set, this bit causes a Program Interrupt (PI).

12   SYSRST   System Reset

This bit will be set by the channel execution of a System Reset sequence as described in the IBM document *Channel to Control Unit OEM Interface Manual*. When set this bit will cause a Program Interrupt.

11   INFDSC   Interface Disconnect

This bit is set when the channel performs a disconnect operation with the Control Unit.

Channel Status Flags

10   UCHKS   Unit Check Sent

Unit Check was included in status sent to the channel.

09   CHENDS   Channel End Sent

This bit is used to notify the emulator that CHEND status was sent in a status response.

08   BSYS   BSY Sent

BSY status bit was sent to the channel.

Channel Initiated End Indicator

07   CHIS   Channel Initiated (CHI) Selection Sequence End

This bit is set when a channel initiated sequence has been completed with the control unit. This bit becomes a zero when the DXDS is reset after the DXDS is entered in the tumble table.

Control Unit Initiated (CUI) End Indicators (PDP-11/DX11B)

06   ESEND   Ending Sequence End
This bit will set when a status byte is presented to the channel by a DX11 initial-
ized sequence and/or when a stacked status is finally accepted.

This bit is most commonly associated with the Ending Status presentation type of
sequence which normally follows a Data Transfer Sequence.

It may under some circumstances occur that the CHIS bit is set as a result of a
CUI-ISS contention situation where the device address requested matched with
the device address selected from the channel and the CU was requesting present
status.

05   CHDEND   Channel Data End
This bit is set during a Data Transfer Sequence when the channel byte count over-
flows (Command-Out is sent in response to Service-In). This bit in its true state
causes the CU to terminate the Data Transfer Sequence. This bit is also set when
the CH terminates a Data Transfer Sequence by interface disconnect (INFDSC=1).

04   CUDEND   Control Unit Data End
This bit is set during a Data Transfer Sequence when the DXBC (byte count)
register goes to its all zero state. When set, this bit causes a PI and also causes
the DONE bit to assert. When this bit asserts, it causes
the CU to terminate the Data Transfer Sequence.

Special Indicators
03   ISSREJ   Initial Selection Sequence Rejected
This bit is set when a channel-initiated selection sequence addressed to the CU
was answered by the CU with a Control Unit Busy status indication and a short
Control Unit Busy sequence. This can only occur if the CUBSY bit in the DXCS
was set when the CH tried to initiate an ISS and the CU was in its idle phase.

02   CMDCHN   Command Chaining
This bit sets if the channel has indicated that another operation will probably
follow for the CU/Device currently connected when the DX11B presents Device
End status to the channel. Command chaining occurs when the current 360
Channel Command Word (CCW) has its command chaining bit set. The channel
informs the DX11 of this by raising Suppress-Out at the same time as Service-Out.

01   STKSTB   Stack Status Copy
This bit is set when the Channel (CH) informs the DX11 that the status byte being
presented on the BUS-IN cannot currently be accepted by the CH. This occurs
when the CH responds to Status-In with Command-Out.
STKSTA may be set by the program if the DX11 is not active with the CH
(LOCK=0). This is useful when initiating a DX11 request for status presentation.
If Suppress-Out and STKSTA are both true, the DX11 drops its Request-In since
the status contained is suppressible (once status has been stacked the CH also
defines that status as suppressible). Since this bit is a copy of STKSTA, it is read
only and is not reset with the rest of DXDS.

00   CMDREJ   Command Rejected
A Channel Initiated Selection Sequence command was ignored due ⁻
a busy device, a pending status, or an illegal command for the devic.·

DXCA   COMMAND AND ADDRESS
DXCA contains the control unit command register, CUCR,
address register, CUAR. These two bytes are the add.
mitted from the channel during an initial selection seque
stored as the second tumble table entry upon

COMMAND AND ADDRESS REGISTERS

15	14	13	12	11	10	9	8	7	6	5	4	3

CONTROL UNIT
COMMAND REGISTER

CⁿⁿTⁿⁿⁿ
ADD.·

BITS			
15-08		CUCR	The odd byte of the DXCA register contains the Control Unit Command Register (CUCR). The CUCR cannot be loaded by the program. This byte contains the last command sent by the channel (even if it was rejected by the DX11).
07-00		CUAR	The even byte contains the Control Unit Address Register (CUAR). The CUAR is loaded with the device address from Bus-Out during an initial selection sequence. The CUAR is also loaded and cleared via PDP program control if LOCKO is a (0). The CUAR need not be loaded with some device address that is to be supported by the DX11 prior to going ON-LINE.

DXCS

CONTROL UNIT STATUS

This register contains the primary control command information bits and primary status indications for the DX11. The DXCS may not be modified by the PDP program when LOCKO equals one (except for DONE and INTEN).

CONTROL UNIT STATUS REGISTER

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

STOP ON PARITY ERROR GUAGE
CONTROL UNIT FORCED BURST MODE ENABLE
CONTROL UNIT END ENABLE
CUBSY ENABLE
ON-LINE REQUEST ENABLE
CONTROL UNIT BUSY ENABLE
SEQUENCE ENABLE
INTERRUPT ENABLE
STACK STATUS
EXTENDED BUS ADDRESS
FUNCTION
GO

BITS			
15		PARSTP	**Stop on Parity Error Enable** If this bit is set to a one and a parity error occurs on Bus-Out during a Data Transfer Sequence, then the sequence is terminated and CUDEND will be set. If this bit is not set, PARER may still become set but the sequence will end normally.
14		CUFBM	**Control Unit Forced Burst Mode Enable** This bit can be set by the program when CU Forced Burst mode is desired. This condition causes the CU to hold OPL-IN up from initial selection through the presentation of Channel End (except for TIO and IIIO).
		ENDEN	**Control Unit End Enable** This bit is set and cleared only by the PDP-11 program. The purpose of setting this bit is to assert the control unit end bit (CUEND) in the device status presented to the channel during a control unit busy sequence; i.e., where the CUBSY bit is already set.
			Reserved
08		BSYS	**CUBSY Enable** This bit enables the setting of CUBSY immediately upon responding to an ISS (either CUI or CHI). This bit is set to a one by the program for emulating any single thread (shared) control unit such as 2848, 2803 and 2821. It is set to zero for one-thread control units such as 2703.
			Reserved This bit is reserved for future use.

| 09 | ONLINA | **On-Line Request Enable** |

This bit is writable (except when LOCKO is set) by the PDP program to either the one or the zero state. ONLINA indicates that the control unit has made or is making a request to go on-line to the 360 channel. It is a two-stage operation. This is the lower stage of going on- or off-line operation and is the stage loaded or cleared by program command (ONLINA: DXCS(09)). The upper stage is the operating on-line bit ONLINB (DXCB(02)). ONLINB follows the changes of ONLINA at a time when, as specified in the OEM channel manual (IBM), it is proper to make changes from on-line to off-line or from off-line to on-line. (The CH is considered on-line itself whenever Operational-Out is set.)

| 08 | CUBSY | **Control Unit Busy Enable** |

Setting this bit will cause a channel initiated sequence to be answered by the DX11 with a Control Unit Busy Sequence. This bit causes the BSY bit to assert to the BUS-IN during the subsequent status presentation from the DX11. This bit is set and cleared by program and by the DX11 hardware if so enabled by BSYEN.

| 07 | DONE | **Sequence Done** |

The DONE bit is the normal interrupt producing condition which the DX11 uses for its primary interrupt control (c.f., INTEN). If both DONE and INTEN are set an interrupt will be requested.

Clearing DONE is required (of the program) only before making an attempt to change registers. With DONE reset, the DX11 will reset LOCKO if the DX11 is in either phase 0 or phase 7. Loading DONE is allowed only in phases 0 or 7.

| 06 | INTEN | **Interrupt Enable** |

This bit is always writable. It is recommended that this bit always be set before setting ONLINA and that ONLINB (via ONLINA) be cleared prior to clearing this bit. This bit may be cleared or set by program control only.

| 05 | STKSTA | **Stack Status** |

If set, STKSTA indicates that status was stacked. When cleared, it indicates that status was accepted. It may also be set voluntarily by a program that is presenting a suppressible (or low priority) status. It is also set automatically by the DX11 when the CH requires a status to be stacked and the DX11 will attempt to present it again.

| 04, 03 | XBA | **Extended Bus Address Bits** |

These bits are the two extended most significant bits of the memory address register during data input/output. They are loaded and cleared under program control and may be caused to complement should the DXBA overflow from a DXBA increment of +2 during a data transfer. They are used only during a data sequence.

| 02, 01 | FCTN | **Function** |

These two bits make up the DX11 function register. It is used by the program to select the CU operations desired:

FCTN=0—reset the DX
FCTN=1—input data transfer (from 360/370)
FCTN=2—output data transfer (to 360/370)
FCTN=3—present asynchronous status (to 360/370)

| 00 | GO | |

When the GO bit is set, the function requested is performed. If FCTN=0 the reset operation is done on the DX11 and the DONE bit is left cleared.

If FCTN is not zero, then Request-In (REQI) will be raised as the start of a Control Unit Initiated (CUI) sequence.

| DXOS | | **OFFSET AND STATUS** |

This is a two-byte register. The odd byte (CUOR) contains the offset the Status Pointer Word (SPW) table located in PDP-11 memory. The even byte (CUSR) contains the status byte that will be presented to the 360/370.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

CONTROL UNIT
OFFSET REGISTER

CONTROL UNIT
STATUS REGISTER
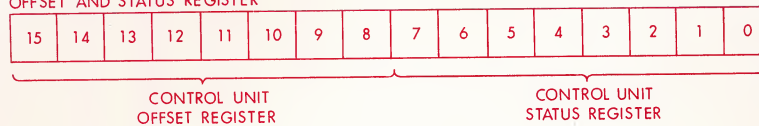
BITS

15-08	CUOR	Control Unit Offset Register

The CUOR contains the high order six bits of the SPW table and of the tumble table. It is program-loaded while in the off-line mode.

07-00	CUSR	Control Unit Status Register

The CUSR contains the standard IBM status information bits which are transmitted to the channel.

07	ATTEN	Attention
06	STAMOD	Status Modifier
05	CUEND	Control Unit End
04	BSY	Busy

The program should not directly set this bit. This bit is set only by a CU Busy Sequence or by being loaded as the status portion of the Status Pointer Word.

03	CHEND	Channel End
02	DEVEND	Device End
01	UCHECK	Unit Check
00	UEXCEP	Unit Exception
DXBA		BUS ADDRESS REGISTER

The bus address register is a 16-bit register which can be cleared and loaded under program control if LOCKO is not set (0). It is used during data transfers to point to the PDP-11 core location to/from which data will be transferred 16-bit words at a time. The DXBA register is also used during channel initiated sequences to fetch both the Status Pointer Word and the device status byte from PDP-11 core. During a data transfer the DXBA is preset by program to point to the first byte location where data is sent or stored. The DXBA register is incremented by two each time a PDP data word is fetched or stored in core during the data transfer process. Should the DXBA register overflow, the extended memory address bits (XBA) in the DXCS register will be caused to complement their states appropriately. The DXBA is also used to address the tumble table when information is to be stored there.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

BUS ADDRESS REGISTER

XBA(00)

The low order bit of the DXBA is normally set to zero by program load. When this bit is placed on the UNIBUS address lines (ABUS), it is always represented as zero. This bit is also used to initiate the BALF flop when control is transferred to phases 5 or 6 to select the odd or even first byte of the first data word.

BYTE COUNT

This register is used only during data transfers. It is loaded and cleared under program control and is set up prior to the data transfer involved. The DXBC is set to the negative of the number of bytes to be transferred. As each byte is actually transferred to/from the DX11, the DXBC register is incremented by one until all bytes are transferred, whereupon the DXBC equals zero. When the DXBC contents go to zero during a Data Transfer Sequence, the CUDEND bit of the DXDS will set, thereby terminating the data transfer sequence with the channel.

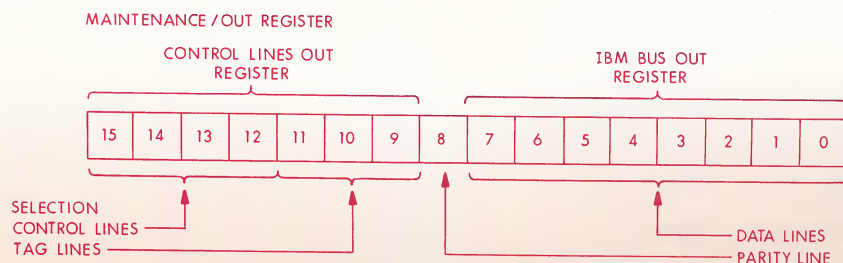| 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

BYTE COUNT REGISTER

DXMO   MAINTENANCE-OUT
This register is used for holding the 360 Channel Bus-Out Data and Tags. This register is always directly readable by a PDP-11 program.

When the DX11 is On-line, the bits in this register are usually the same as what appears on the Bus-Out lines (hardwired cables to the Bus-Out Plug).

When the DX11 is Off-line, these bits may be written directly by a PDP programmed request. The programmed bits are held buffered in the DXMOB. When the DX11 is On-line but cabled to the Bus-Out Test Plug, these bits are also writable by PDP-11 programs. The on-line cabled mode is used to isolate the cables and Bus-Out receivers as an error source.

MAINTENANCE / OUT REGISTER

CONTROL LINES OUT REGISTER   IBM BUS OUT REGISTER

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

SELECTION
CONTROL LINES
TAG LINES
DATA LINES
PARITY LINE

BITS
15-08   CONO   Control Out-Lines Register
This byte contains the following signals as strobed from either the Bus-Out lines or from CONOB:

Selection Control Lines
15   OPLO   Operational-Out
This line indicates that the channel is in operation.

Note: refer to IBM manual A22-6843 for detailed description of each line of the 360 bus.

14   HLDO   Hold-Out

13   SELO   Select-Out
This bit is set only if both hold-out and select-out are set. When set or cleared by a PDP-11 program, only the simulated select-out signal is affected (see DXMOB).

12   SUPO   Suppress-Out

Tag Lines
11   ADRO   Address-Out

10   CMDO   Command-Out

09   SRVO   Service-Out

Parity Line
08   PARO   Parity-Out
This bit does double duty when written by a PDP i
on-line cabled mode. At such times the state o'
into the state of the Simulated Clock-Out line (of
the Parity-Out line. Clock-Out's primary purpc
units to make changes in their ON/OFF-LINE sta.e.

Another function of the bit is to allow the program generation of either normal (odd) Parity-Out or "bad" (even) Parity-Out. This feature is necessary in order to permit checking the parity generator within the main DX11 logic.

Data Lines			
07-00	BUSO		IBM Bus-Out Register

BUSO — IBM Bus-Out Register
Bus-Out data bits 0 to 7, as seen either directly from the Bus-Out Cables or from BUSOB, if off-line.
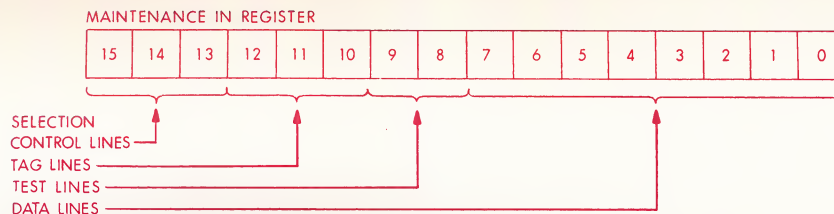When written by the PDP-11 program, this byte is buffered in BUSOB.

DXMI — MAINTENANCE-IN
This register is used for reading the Bus-In Tags and data originating mainly from the main DX11 logic. In this way the register represents the channel's view of the Bus-In. The output of these flops is enabled to the Bus-In lines either whenever OPLI=1 or whenever a fast CU-Busy is in progress.

The register is normally read only, but for maintenance purposes programmed modification is permitted except for CLKO and PARI.

When the DX11 is off-line, the data read by PDP-11 programmed references come directly from DXMI. When the DX11 is on-line, the data read by the PDP-11 program comes from the Test-In plug. Correct data will be seen then only if the plugs are cabled together.

MAINTENANCE IN REGISTER

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

SELECTION CONTROL LINES
TAG LINES
TEST LINES
DATA LINES

BITS

15-08 CONI — Buffered Control Lines in Register
This byte contains the following signals:

Selection Control Lines

15	OPLI	Operational-In
14	SELI	Select-In (not direct cleared)
13	REQI	Request-In

Tag Lines

12	ADRI	Address-In
11	STAI	Status-In
10	SRVI	Service-In

Test Lines

| 09 | CLKO | Clock-Out signal from Bus-Out |

This line always comes from the cables, even when the DX is off-line.

| 08 | PARI | Bus Parity-In (not a flip-flop—output of parity generation for BUSI) |

Data Lines

07-00 BUSI — Buffered Bus-In Data Register
This byte contains the data that is enabled to the Bus-In lines for transmission back to the IBM 360 channel. The output of this byte also is always input to a parity generator that produces the signal PARI.

DXC — CONTROL BITS
This is a 16-bit register containing control bits such as LOCKO, phase flip-flops and state. It is a read only register used by the diagnostics to determine the condition of the DX11B.

DXND — NON-PROCESSOR REQUEST (NPR) DATA
This is a 16-bit register to/from which NPR data moves. It is readable for diagnostic purposes.

DXES1		**EXTRA SIGNALS**

EXTRA SIGNALS
This is a two-byte register containing the tumble table index and some miscellaneous signals. The odd byte contains the Tumble Table Index (TTNDX). It indicates the word-pair address for the next tumble table entry to be made by the DX11B. The even byte (MISC) contains miscellaneous control signals for DX11B maintenance diagnostic purposes.

15-08   TTNDX   Tumble table index byte
This byte is the low order address of the tumble table entry to be used next. It is shifted left before being copied into the DXBA.

07-00   MISC   Miscellaneous control signals byte

07   Reserved

06   ODD   Copy of DXBA(00) (for future use)

05   NPRTO   NPR latency error. Bus grant not received within timeout interval.

04   DXTO   Program response latency error. While OPL-IN was up, the program did not interact for a 5-second period.

03   TIMDIS   Set to disable DXTO during program debugging.

02   SOSIEN   Fast NPR test enable. Cause simulated SRVO to follow SRVI.

01   MCLKEN   Maintenance clock enable
When this bit is set the DX does not change time states until MCLKP is set:

00   MCLKP   Mainenance clock pulse
If MCLKEN is set, setting this bit causes the DX to enable the next time state.

One normal clock pulse will be issued with each setting of MNCLKF, the Clock pulse thus generated will reset the MNCLKF. The UNIBUS interface continues to run at normal speed at all times. Maintenance clock mode cannot be entered when on-line.

DXMOB   MAINTENANCE-OUT BUFFERED
This is a 16-bit register containing the buffered setting of the Control-Out and Bus-Out lines. It is read only. It consists of the flip-flops that are set when the program writes to DXMO. When the DX11B is cabled back to itself and on-line, a comparison of the contents of DXMOB and DXMO is an indication of the operational condition of the DX11B drivers and receivers and of the IBM cables.

DXES2   EXTRA SIGNALS
Contains interval signals for DX11B maintenance diagnostics.

15-02   Reserved

01   DSCRSP   Disconnect response
Hardware controlled latch that enables 'Fast CU busy' and 'Propagate Select Out' during Phases 4 and 7. Immediately after an Interface Disconnect. This allows Operational-In to be dropped in Phases 4 on an Interface Disconnect to meet the 6 μsec timeout requirement.

00   IRS   IBM reset conditions stored
Hardware controlled latch to cause an IBM reset condition (Interface Disconnect, System Reset, Selective Reset) to be stored in the tumble table when condition was recognized during Phase 4 or 7.

Status Pointer Word (SPW) and Device Status Table (DST)

The Status Pointer Word (SPW) is accessed by the DX11B during an Initial Selection Sequence (ISS) to determine the status of the 360/370 device selected. During the ISS, the DX11B must present status for the command issued by the 360/370 for the device indicated by the DX11B when it presented Address-In. The SPW is used to perform that function.

The SPW is a word table indexed by the Control Unit Offset Register (CUOR). A 256-word memory area is reserved for the SPW. Word 0 of the SPW contains the SPW entry for device 0, word 1 for device 1, . . . , word 255 for device 255. The SPW is always on a 512 word PDP-11 memory boundary.

The SPW is a two-byte entry. The even byte contains channel status information. When an access is made to the SPW, the even byte is loaded into the Control Unit Status Register (CUSR). The odd byte contains either 0 or an offset value. If=0, the content of CUSR is the status response to all commands for this device. No further NPR operations are required for status. If the odd byte contains an offset value and the even byte is zero, the odd byte is used as the pointer to a 256-byte Device Status Table (DST). The 360/370 command is used as an index into this table to retrieve a unique status for that command. The DST status is retrieved if the SPW even byte is zero and the odd byte is other than zero. If the status byte is retrieved, it is loaded into the CUSR to become the status byte that will be presented to the 360/370. Each device can have the same, a unique, or no DST, as determined by the requirements of the control unit and devices being emulated. For each DST specified, 128 words must be reserved. The meaning of each status bit is 360/370 device-dependent. The DST is always located on a 128 word PDP-11 memory boundary.

Tumble Table (TT)

This is the name given the circular buffer in which the DX11 stores an entry at the end of each interface activity. The interface activity can be channel (360/370) or Control Unit (PDP-11 emulation) initiated.

A 256-word area is reserved for the TT: Each entry consists of two words. The content of the two words will be the value of DXDS and DXCA, respectively, at the time the channel activity occurred. The entry is guaranteed to be other than zero. TTNDX is the index to the next TT entry to be used by the DX11B. The program must zero the slot after using it. Each entry made by the DX11B causes an interrupt and sets the DONE bit. The program can service all table entries on each interrupt. The program must keep its own TT pointer. The TT is physically located in the next 256 words above the 256 word PSW table.
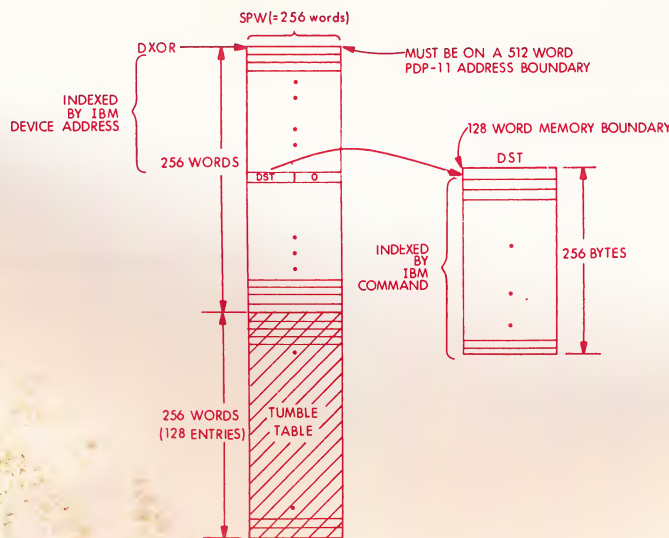
DX11 PROGRAMMING TECHNIQUES

Interrupt and Tumble Table Servicing

Because the DX11B must respond to Initial Selection Sequences every 32 microseconds, a tumble table is used to indicate one occurred. An interrupt is generated when the entry is made. If the program permits an interrupt for every entry, it will be impossible to service an interrupt in 32 microseconds. Besides, a subsequent table entry may cancel an operation specified by a previous entry. Therefore, it is desirable to service all tumble table entries when an interrupt occurs. The recommended interrupt procedure is:

Clear the DONE bit.

Service all tumble table entries until a zero entry occurs, clearing the TT entries as they are processed.

Build a queue of operations to be performed.

Load the registers (DXCS, DXOS, DXBA and DXBC) with the required data to perform the first operation: set the GO bit.

As the queue of operations is built, a subsequent TT entry may cancel one of the operations in the queue. It is important to be able to delete an operation from this queue.

It must be remembered that the 360/370 channel is always master and the control unit cannot perform a function the channel has told it to terminate.

NOTE: Under no circumstances should the Interrupt Enable bit of the DX11B or any other PDP-11 peripheral be cleared while the DX11B is on-line. Otherwise a NO-SACK timeout may occur which in turn can cause DX11B NPRTO error.

Byte Multiplexed Versus Burst Mode

NPR operations are used for data transfers, Burst mode is defined as any data transfer longer than 32 microseconds. When byte multiplexed mode is desired, the program must break up a block of data into 4-byte segments and initiate a Control Unit Initiated (CUI) operation for each segment. CUI is initiated by raising the REQUEST-IN control line. DXBC should never be loaded with a value greater than minus 4 if multiplexed mode is desired.

Tumble Table Overflow Detection

Programming is used to detect Tumble Table Overflow. The TT can hold 128 entries. This will normally be more than enough. However, it is possible for an overflow to occur.

Overflow is defined as follows:

The program has a pointer to the tumble table entry it serviced last. When it uses the contents, it zeros the entry. When it is ready to service another entry, overflow has occurred if the previous entry (still indicated by program pointer) is other than zero.

Overflow is an irrecoverable error. The program should present UNIT CHECK status for each active device and go off-line.

PROGRAMMING CONSIDERATIONS

This paragraph contains a discussion of some of the general programming considerations that pertain to the DX11-B.

Hardware/Software Interlock

Because of a contention situation that can arise when both the channel and the control unit (through software request) attempt to use the interface, an interlock mechanism is necessary to protect information used by both parts of the system. The control unit can appear busy to channel activity when the control unit software must use the facilities. After system reset, while table initialization is in progress, the CUBSY flip-flop is set.

The general solution is simply to let CH requests always override CU requests. This is done by the LOCKO flip-flop which prevents further changes to the DX11-B registers once a selection sequence has begun. The program can later examine the interrupt conditions to determine if the program requests must be repeated. LOCKO gets DXCS, DXCA, DXOS, and DXBA. Only DXBC remains program-writable.

Boundary Considerations

    a. The SPW, TT firmware is 512 words long and must begin on a 2000_8 address boundary

    b. All DSTs are 256 bytes long and must begin on a 400_8 address boundary.

    c. All data transfers should begin on an even boundary. On input operations, the following will occur for odd BA and odd BC, respectively:

        1. When starting an input on an odd address, the *previous* even address byte is clobbered.

        2. When ending an input on an even address, the *following* odd address byte is clobbered

    d. On output operations, as many as two words *following* the end of the data buffer can be r Therefore, buffers should not be assigned at the *end* of core. This prevents spurious NXMs

Interrupt Request

When the DX11-B requires either a program interrupt or tumble table service, it sets ' set. When the program is ready to try a CUI, it must clear DONE; then, if no nev DX11-B will clear LOCKO.

<div align="center">

NOTE
Clearing INTEN is discouraged during DX11-B o

</div>

The following rules should be followed:

    a. The TT entry should be zeroed after being serviced.

    b. On an INT, *all* nonzero TT entries should be serviced before dismissing INT (RTI).

    c. Software should keep a pointer to current TT entry. This should follow the hardware pointer in relieving the entries the hardware places (hardware will guarantee a nonzero TT entry).

d. No software requests for data transfer or status should be made until all TT entries are serviced.

e. *Before* each TT entry is serviced, DONE should be cleared with a

   BIC # DONE, DXCS

thus, the general INT service procedure is:

1. Clear DONE.
2. Service current TT entry. Update action to be performed for device whose address is in TT entry. Do not request data transfer or status at this time. (Note that this may *cancel* a previously queued request for this device.)
3. Clear TT entry.
4. Bump software pointer to next TT entry.

<div align="center">

NOTE
If TT entry not 0, go back to Step 1. If it is 0, proceed.

</div>

5. When a zero TT entry is encountered, initiate *last* action pending for each device.
6. Dismiss interrupt (RTI).

Data Transfer

Data transfer sequences (DT) are always initiated by the DX11-B program. It is a software responsibility to ensure that a DT is valid at the point requested. Information supplied to the hardware includes Buffer Start Address (DXBA), byte Count (DXBC), Device Address (CUAR), and I/O direction (FCTN—input or output). The hardware will get control of the I/O interface and transfer the data in a single burst, after which it will generate a Data End interrupt. The last bit set is the GO bit. If LOCKOUT is set at this time, the effect is a NO OP and the result is no data transfer.

Several other events can happen as follows:

a. A bus out parity error can occur, setting PARER. This will terminate data transfer with PARSTP.
b. A timeout reference can occur, setting NXM.
c. The channel can indicate I/O stop, setting CHDEND.
d. An Interface Disconnect can occur.

If a CUI is used, it could be overridden by an ISS, in which case an interrupt would occur; but different bits would be set in the DXDS and copied into the tumble table.

Status Presentation

There are several cases in which presentation must be initiated by the program as follows:

a. When stack status is indicated by the channel. In this case, the DX11-B will automatically request presentation of the status again, until it is subsequently relieved or overridden via an ISS (only if BSYEN=1).
b. When ending status is initially available for the device (DEVEND, etc.).
c. When asynchronous status becomes available for the device (DEVEND or ATTEN).
d. When a device that had previously been interrogated while busy becomes free (CUEND or DEVEND).
e. At the termination of a data transfer (CHEND or CHEND+DEVEND).

The program loads the status and device address and requests status presentation (FCTN=3). If the status is accepted, the device status, device address and command (if any) are loaded into the tumble table and an interrupt is generated.

──line Control

──INA flip-flop is written by the program to request a change of on-line status. The ONLINB flip-flop, in ──erify that the transition occurred. The program clears the ONLINA flip-flop to attempt to ──he ONLINB flip-flop will not clear if any channel activity is in progress.

<div align="center">

NOTE
When the program sets ONLINA, the ONLINB flip-flop will
only set if the hardware ON-LINE/OFF-LINE switch is in the
enable position when channel conditions permit.

</div>

An on-line/off-line ──── an be made at any time. If channel activity occurs at the time ONLINA is cleared, it will not clear. This a──── the program a chance to reconsider the off-line request in view of the new CHIS.

<div align="center">

NOTE
An On-line/Off-line sequence should not be attempted in an
interval less than 10 ms.

</div>

ORDERING INFORMATION

DEC No.	Description	Prerequisite
DX11-BA	360/370 channel interface w/115V 60Hz power supply and an H950 standard PDP-11 cabinet	PDP-11 (PDP-11/20 or PDP-11/15 w/ KH11-A Option & Comtex Software)
DX11-BB	360/370 channel interface w/230V 50Hz power supply and an H950 standard PDP-11 cabinet	same

APPLICATIONS

The DX11B can be used for any application where it is desirable to have a PDP-11 as a pre- or post-processor to either a S/360 or S/370. With its ability to emulate a 2848 display or a 2703 or 3705 communications controller, it is compatible with OS/GAM, BTAM, QTAM and TCAM and DOS/BTAM and QTAM. It can be used in systems designed for the following applications:

1. Front-end processors
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digital

RSTS-11
PDP-11 RESOURCE TIMESHARING SYSTEM

RSTS-11

RSTS-11 is based on Digital Equipment Corporation's 16-bit PDP-11 small computer...a state-of-the art design uniquely suited for on-line systems.

RSTS-11's problem solving power is derived from BASIC-PLUS, an enlarged and enriched version of BASIC, the most popular timesharing language in use today. BASIC-PLUS is easy to use and has the added flexibility that makes it a true general-purpose language for solving a wide variety of problems.

RSTS-11's flexibility benefits:
Scientists and Engineers who need—

- an easy-to-use tool for analysis of experimental data and design calculations.
- a low-cost alternative to expensive timesharing subscription services.

Administrative managers who need—

- a multi-terminal system for on-line data processing.
- a system for administrative problems which operates concurrently with computational timesharing and uses a card reader, line printer and files on disk or magnetic tape.

Educators who need—

- low-cost "hands-on" access to a computer for students.
- a problem-solving tool for research projects.
- a computer system for administrative data processing.

RSTS-11 is for anyone who needs a conversational, general-purpose, timesharing capability for solving a broad range of problems.

the RSTS programming language...BASIC-PLUS

RSTS-11 programs are written in an extended form of the programming language, BASIC, developed at Dartmouth College. Two programming modes are available: the desk calculator mode for line-at-a-time statement execution, and the stored program mode for multi-line execution. BASIC-PLUS is essentially compatible with all widely-used implementations of BASIC, including those available from timesharing service companies. Thus, BASIC programs developed for other computers will execute properly with little or no modification on RSTS-11. The primary goal of the original developers of BASIC was to provide a language which could be quickly learned and easily used in a student environment. Therefore, RSTS-11 terminal users with no previous computer experience can be introduced to a subset of BASIC-PLUS comparable to Dartmouth BASIC and be performing useful problem solving tasks within a matter of hours.
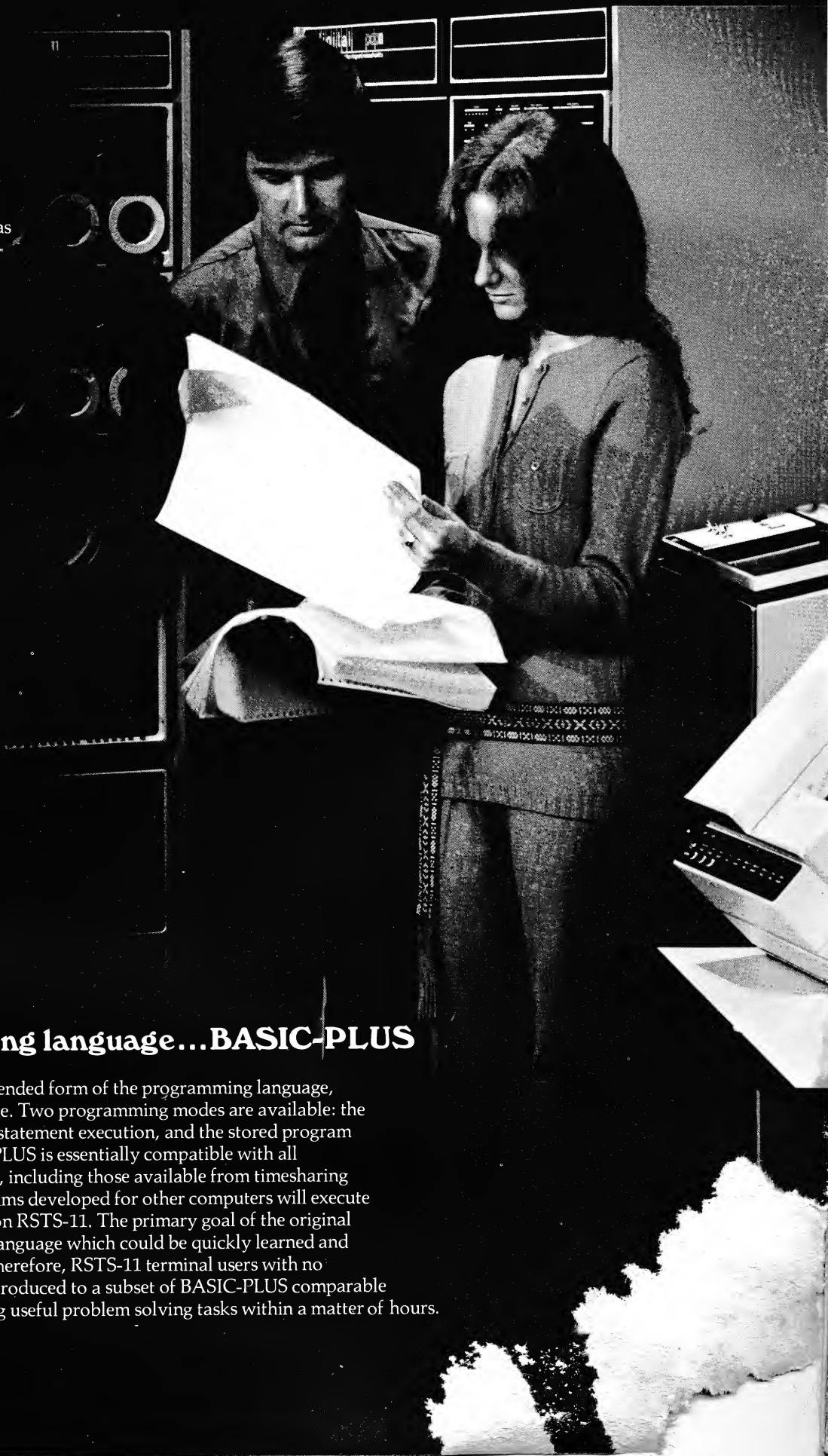
features

Large Capacity

16 simultaneous and independent jobs can be performed such as program editing, compilation, and administrative processing. Each job is independently controlled from an on-line terminal.

Economical

low cost per terminal and easy incremental system growth.

BASIC-PLUS Features

BASIC-PLUS is an extended form of BASIC with many powerful features and is compatible with regular BASIC. Use your existing BASIC program library with little or no reprogramming. STRINGS, on-line FILES, MATRICES, and data processing features have been added to give BASIC-PLUS more problem-solving power.

Large Core Storage Capacity per Terminal

Each terminal can utilize up to 16,000 eight-bit bytes (or, 8,000 16-bit words) of high-speed core memory storage for program and working data. If more is needed, programs may be easily chained from high-speed, on-line disk storage.

Multi-device Access

Each terminal can access a wide variety of peripheral devices for high-speed input and output of data files and programs. For example, an administrative job may utilize a card reader, magnetic tape and disk data files, and line printer; other terminals may simultaneously utilize a DECtape for creating a data file which will be stored off-line, etc.

On-Line File Storage

Terminals may simultaneously access up to 12 data files from within a program and store and retrieve other programs and data files from an on-line disk library that has up to 32 million bytes of usable file space. There is no limit to the number of files that may be opened and closed under program control.

Expandability

RSTS-11 software and hardware grow as your requirements grow. You control the growth—this means your system never outdistances your needs.

Security

Each terminal user is assigned a password to prevent unauthorized system access. In-house system ownership means programs and data cannot be compromised by outsiders. Files can be stored on-line and protected from access by other terminal users.

Easy To Operate

RSTS-11 needs only a few simple, easy-to-understand system commands. New terminal users can be solving problems after only a few minutes of experience at a terminal. RSTS-11 is easier to use than a desk calculator.

General Purpose Utility

The extended features of BASIC-PLUS coupled with large program capacity, on-line library file storage and high-speed peripheral device access work together. RSTS-11 problem solving power can be distributed via remote, on-line terminals to where the problems are—computational *and* administrative.

Choice of Terminals

RSTS-11 supports a wide variety of terminals operating at a wide variety of speeds. Teletypes, typewriters, CRT displays, or the new DECwriter (a 30-character-per-second hardcopy terminal), may be used as terminals.

...sponse

RSTS-11 timesharing eliminates the costly and frustrating wait of one-at-a-time batch processing; each RSTS-11 interactive terminal user can perform his task at his own speed without frustration.

A RSTS-11 configuration requires only 40 square feet of floor space (excluding terminals). No special power facilities or air conditioning are required. RSTS-11 can be installed and operating in as little as one day.

1

resource sharing: timesharing use of high-speed input/output devices

RSTS-11 terminal users may have exclusive use of any peripheral on a timesharing system (except the disk, which is a shared device). They may use it as long as needed, and then return it for assignment to another user. The ability to enter, store, and retrieve programs and data files using high-speed peripheral devices makes RSTS-11 a true general-purpose problem-solving system.

Examples of the value of the Resource Sharing concept are: one user may use the line printer, card reader, tape and disk files for performing a "batch" administrative data processing task; another terminal user may use a DECtape unit for retrieving or creating a tape file intended for off-line storage; and when the card reader is free, yet

another terminal user may read in a punched-card file which contains a BASIC program he has created at an off-line card punch.

RSTS for business and administrative problem solving

One of the most difficult problems facing business today is increasing the productivity of costly, hard-to-find clerks and secretaries. RSTS-11's power and flexibility offer the benefits of reduced costs, increased customer satisfaction, and increased job satisfaction for clerical workers.

How RSTS-11 Benefits Administrative Applications

- Journals, general ledger, and other account records are stored on-line for quick access from high-speed disk storage, thus reducing paper handling.
- Because RSTS-11 is a full-scale computer system, more of the steps and decisions in accounting applications can be automated, thus reducing the drudgery of accounting operations and the possibility of human errors.
- Records are kept on-line. They can be updated quickly and retrieved easily for generating timely, detailed reports for better management control.
- Customer satisfaction increases when an on-line, RSTS-11 customer account inquiry system reports account status in a matter of seconds.
- Operating costs are reduced because accounting personnel can be trained quickly, work more effectively, make fewer mistakes, and have to handle less paper.

Potential On-Line Administrative Applications include:

- Order Entry/Accounts Receivable/ Sales Analysis
- Inventory Control/Accounts Payable
- Data Entry with automatic error checking, editing, and verification
- Inquiry-Response for "instant" access to records.

RSTS-11 can be dedicated in administrative application systems. The power and versatility of RSTS-11 permit terminals to be used for computational problem solving simultaneously with the execution of administrative applications. Thus, the value of RSTS-11 in an organization can be enhanced, for example, by installing a number of RSTS-11 terminals in the engineering area as well as in administrative offices.
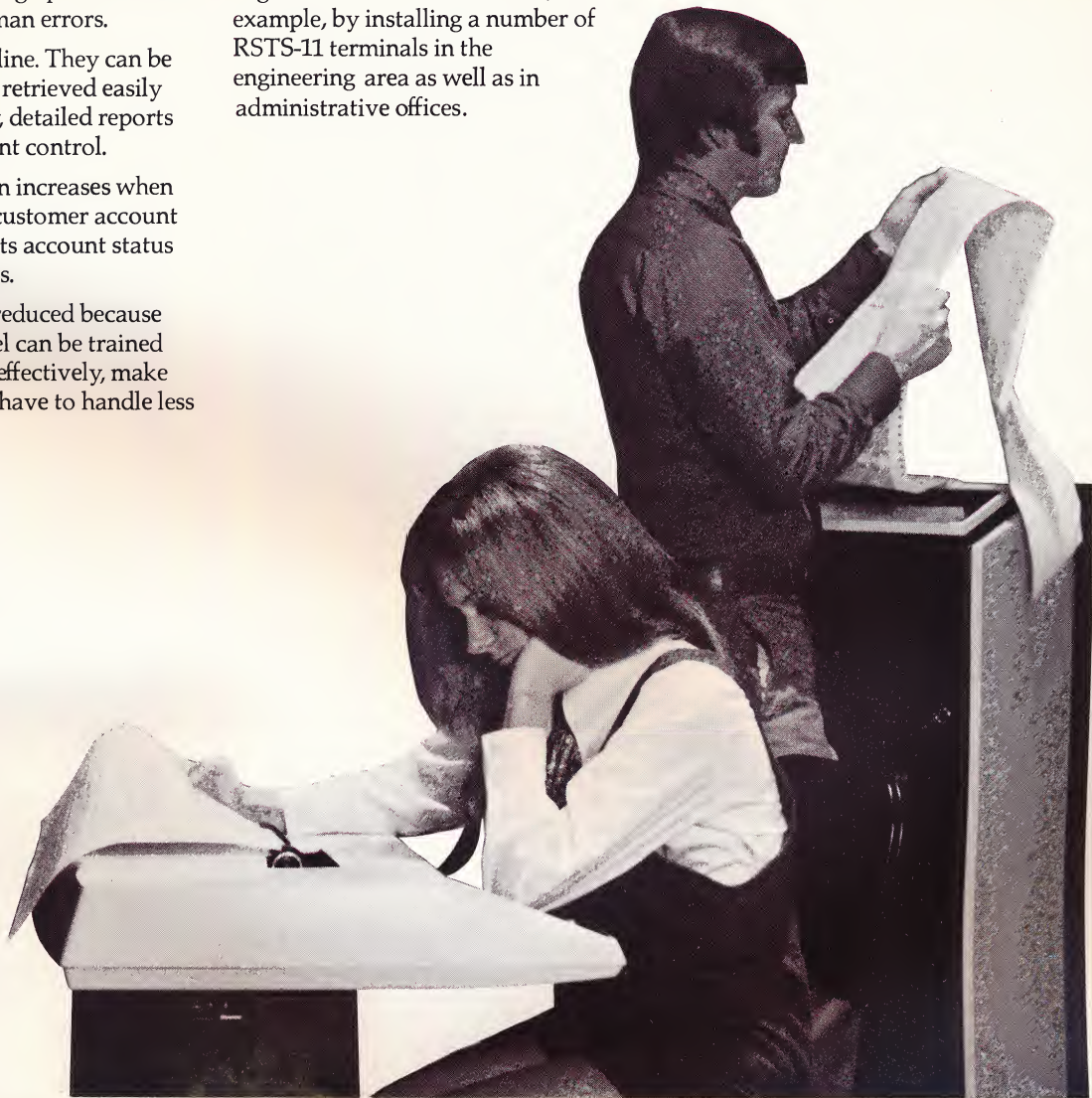
RSTS in schools
for interactive timesharing and administrative applications

The low operating costs of RSTS-11 make it an ideal computer system for schools. Up to 16 students may have simultaneous, interactive, access to a true timesharing computer. And, an expanded RSTS-11 hardware configuration lets you execute administrative applications at the same time while students are using the system for instruction.

Students with little or no computer background can use RSTS-11 terminals for developing computer concepts. More advanced students meanwhile, can perform more complex problem-solving exercises. This is because RSTS-11 has powerful features such as terminal-user core space as large as 16,384 bytes (8192 words). Hence RSTS-11 is valuable in many curriculum areas. For example, students can conduct independent research in simulations, capital budgeting, and computer-aided instruction system development.

BASIC-PLUS programming language is so versatile that students may progress from the introductory stages of computer education to learning very advanced concepts in computer science and data processing. It is not necessary to interrupt the students' progress to learn a new language because they have "outgrown" a programming language. The success of BASIC as an introductory programming language has been proven with thousands of students, beginning with those at Dartmouth College, where BASIC was developed. As students become ready, they may be introduced to more and more of the extended features of BASIC-PLUS. For example, introduction of the PRINT USING statement (useful for complex formatting of printed output) may be deferred until the students are assigned more sophisticated projects. Thus, students with a broad range of computer programming skills may all use RSTS interactive terminals simultaneously, each one utilizing the elements of BASIC with which he is familiar.

RSTS-11 features make it an ideal system for the development of low-cost Computer-Assisted-Instruction (CAI) or Computer-Managed Instruction (CMI) systems. CAI and CMI system operations consist primarily of processing of text in the form of character strings. BASIC-PLUS includes extensive language features which simplify development of efficient CAI and CMI text processing programs. For example, special functions are included that can measure a student's response time or continue a program if there is no response.

Administrative applications can be run simultaneously with timesharing terminal use on expanded RSTS-11 hardware configurations. For example, a Grade Reporting System may be executed utilizing a card reader, high-speed line printer, and magnetic tape or disk files while up to 15 students are each using an interactive terminal to complete their assignments.
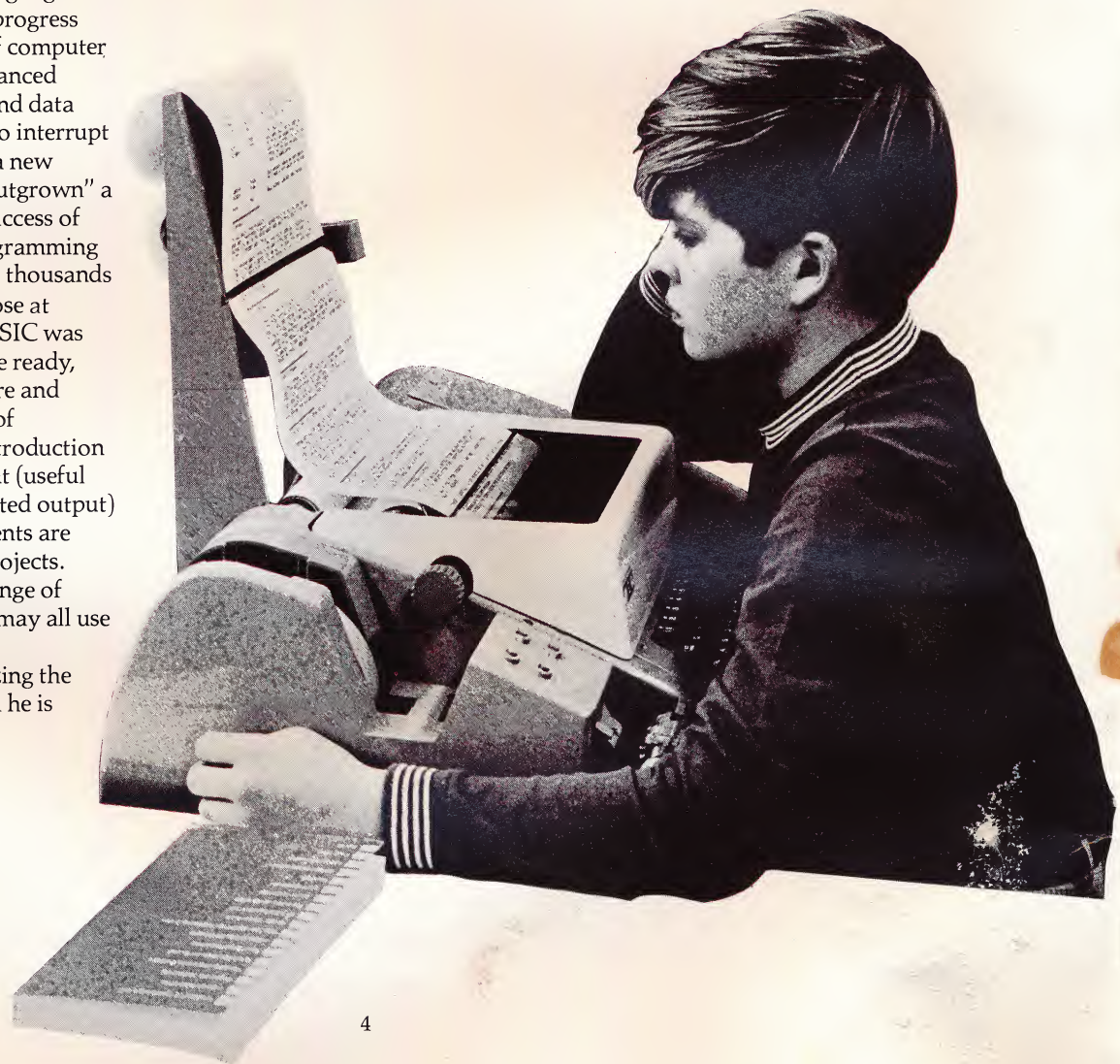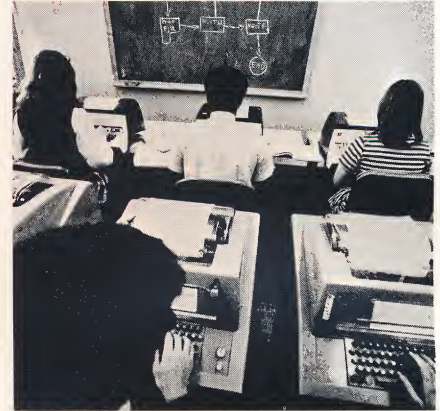
RSTS for in-house timesharing in scientific and industrial environments

BASIC-PLUS with its powerful extended language features makes RSTS-11 an ideal tool for scientific and engineering problem solving. RSTS-11 terminals are easier to use and more flexible than a desk calculator—even for simple problems. And, RSTS-11 has large-scale system features: user core storage of up to 16,000 bytes per terminal; additional programs that can be quickly called from an on-line program library. Sophisticated or simple, all applications can be handled with ease. RSTS-11 terminals can be placed where the problems are. High-speed paper tape and punched-card inputs lets data collected from experiments to be quickly entered and analyzed. RSTS-11 terminals bring computational power to engineers and scientists with the convenience, accessibility, and economy heretofore available only with desk calculators. And, if you're already using a subscription timesharing service, RSTS-11 gives you the same familiar programming language but with many extra extended benefits.
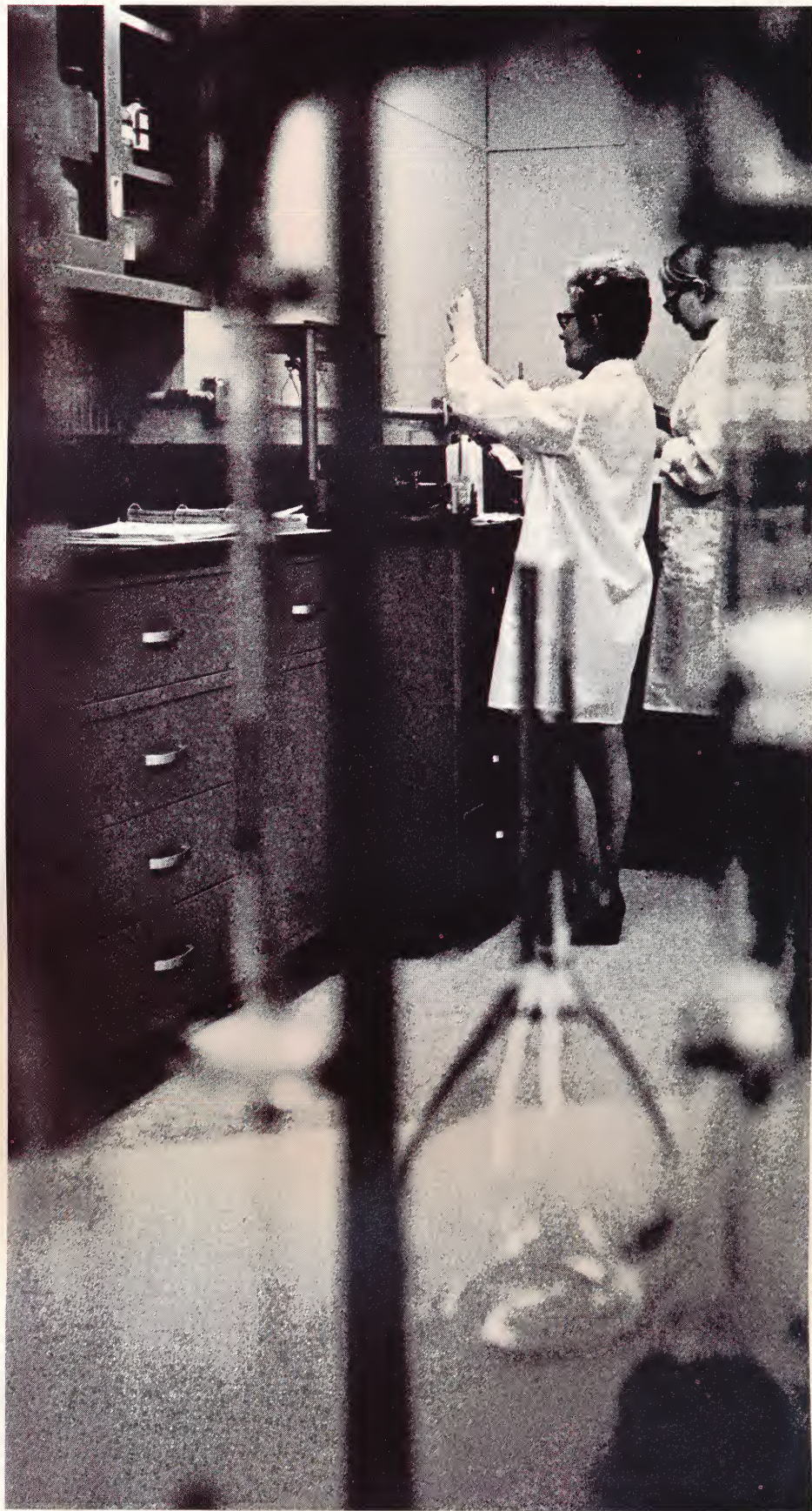
hardware—the PDP-11 computer system

The PDP-11 computer is the heart of RSTS-11. This powerful, state-of-the art computer is ideally suited to fast response timesharing. The PDP-11 features a 16-bit word, UNIBUS™architecture, over 400 instructions, 8-bit byte handling, and a push-down stack for efficient processing of interrupts and subroutines.

the UNIBUS™ —pathway to system expansion

The PDP-11 UNIBUS™is the PDP-11's unique means for intercommunications among all system components of RSTS-11. Any unit—including processor, memory, disk, terminals, and other peripheral devices—may be added to RSTS-11 simply by plugging the unit's controller into the UNIBUS. This modularity means that RSTS-11 can grow as your needs and budget grow. Your investment in RSTS-11 is safe and never becomes obsolete. All future devices for the PDP-11 will always be compatible.

RSTS-11 configurations

Because of PDP-11 flexibility, the initial RSTS-11 configurations may be tailored to closely fit your needs and budget. And, when these needs and budget grow, the configuration may be expanded by adding equipment from a broad range of optional hardware.

A minimum RSTS-11 configuration includes: a PDP-11 computer with 24 K words of memory, a fixed-head disk unit, a dual DECtape magnetic tape unit, a real time clock, a bootstrap-loader read-only memory unit, from one to 16 terminals, terminal interfaces and mounting hardware.

This configuration also supports the program development system, DOS, which may be used for the development and execution of FORTRAN IV and assembler-language programs. See page 11 for further details.

expandibility

The RSTS-11 configuration may be expanded either initially or at a later time with any of the following:

• Additional fixed-head disk units to increase the on-line file capacity available to users.

• Moving-head, removable disk cartridge drives for large-scale on-line file capacity.

• Moving-head disk, removable disk pack units similar to the IBM 2314 for on-line capacity up to 32 million bytes.

• Additional terminals and terminal interfaces (up to 16 total). Terminals may be typewriters, Teletypes, the 30 character-per-second DECwriter, or the high-speed DECdisplay for silent terminal operation.

• Communications line terminal interfaces for remote operation of interactive terminals via telephone lines.

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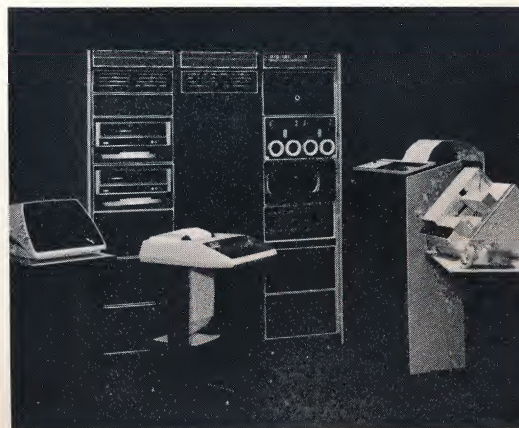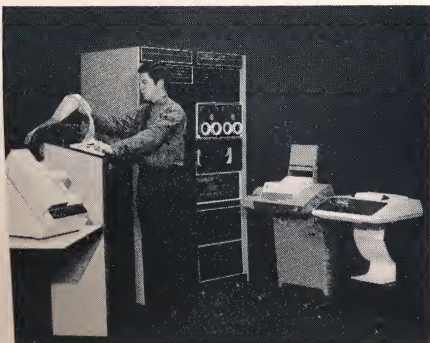
- Card reader for entering punched card files.
- Line printer for producing hard-copy output at high speed.
- Additional DECtape transports for expanding the amount of on-line serial file capacity.
- Industry-compatible one-half inch magnetic tape transports for large-scale on-line serial file capacity and for transferring data files manually between RSTS-11 and other computer systems.

- High-speed paper tape reader and punch for economical input and output of files at medium speed.
- Additional core memory for increasing the core storage area per terminal from 8192 bytes (on the minimum configuration) to a maximum of 16,384 bytes. Additional core also helps improve the responsiveness of the system.

BASIC-PLUS...an expanded language

One of the most significant features of the BASIC-PLUS language is that it has been extended to increase the utility of the system and make it an ideal tool for solving a very broad range of problems. For example, administrative applications such as on-line order entry, inventory control and payroll may be implemented efficiently by using language features suited for data processing. Text-processing applications such as Computer-Assisted Instruction, automatic letter or document editing and production may utilize a set of character string handling functions. The utility of BASIC for computational applications such as structural design and simulation is extended with language features which allow more concise, and therefore, more efficient programming and program execution. BASIC-PLUS eliminates constraints of BASIC for a variety of applications programming tasks.

matrix operations

A variety of operations are available which permit efficient operations upon one and two dimensional arrays of data. Matrix data elements may be character strings, floating-point, or integer-numeric quantities.

Operations include:

- MAT READ
- MAT PRINT
- MAT INPUT
- Initialize matrix to zeroes, ones, or the identity matrix.
- Matrix addition, subtraction, transposition, and inversion.
- Large arrays may be dimensioned, stored, and accessed on an element-by-element basis in an on-line disk file, thereby conserving user core memory space.

string operations

Many applications, including Computer-Assisted Instruction and business data processing, require efficient processing of strings of characters. A string may be up to 512 characters in length. String operations available include:

- Concatenation for appending one string to the end of another.
- CHANGE a one dimensional array of characters to a string or a string to a vector (In RSTS-11, a character string need not be considered as a one-dimensional array of characters).
- A full set of relational operators for comparing one string to another.
- LENGTH function for determining the number of characters in a string.
- LEFT, MID, and RIGHT functions for extracting a string of characters contained within a larger string.
- INSTR for searching for a substring within a string.
- SPACE function for creating a string of N space characters.

print formatting

Many applications, such as business data processing, require more flexible control of the printing format than Dartmouth BASIC allows. BASIC-PLUS includes a PRINT USING statement which may be used to achieve precise definition of printed data format. PRINT USING allows character, decimal, and exponential data field lengths and positions to be defined, and mixed, for a print line. In addition, leading dollar or asterisk symbols may be "floated" to automatically precede the most significant digit of decimal fields. Trailing minus signs for data fields may be specified for compatibility with accounting report standards.

extended program statement coding

The effectiveness of RSTS-11 in solving problems in a broad variety of application areas is significantly increased with the addition of numerous extensions to the structure (syntax) of the BASIC program statements. These highly flexible program statements permit more concise expression of complex program steps. Here are a few examples:

LET A1=P1*R1 IF R1=5.0 OR R1=0.0
GOTO 5530 UNLESS X1$>Y1$ AND Z$="ABC"
LET (Y1,Z1)=Z1+3   FOR Z1=1 TO L
IF X>Y AND Y>Z THEN Z=X ELSE Z=Y
FOR I=X (J) STEP 3 WHILE L$ (I)=L$ (I+1) AND J+I<I2
ON X(2,5) GOTO 100, 150, 200, 250, 300

program recovery from input/output errors

One of the more frustrating situations for a timesharing terminal user is when his program is cancelled because an input/output error condition occurs (perhaps temporary) and causes all results created (in a file, for example) to that point to be lost. This situation, although rare, may be eliminated in RSTS-11 applications by use of the ON ERROR GOTO statement. This subroutine call statement is triggered by a variety of input-output operation errors. The call subroutine is passed a value which identifies the error type, and attempts to recover from the error condition. If the subroutine is successful, normal execution of the application program resumes.

integer data type

BASIC-PLUS includes the definition of integers in addition to strings and floating point numbers. Integers are whole numbers in the range of $-32,767$ to $+32,767$. The use of integers often increases the execution efficiency of programs. The most common uses of integers are in counting and indexing operations.

interval timer

In some timesharing applications, the length of time that a terminal user takes in responding to a message printed at his terminal is a significant variable. The WAIT function provides an interval timer feature which may be used for signaling the program that the terminal user has not responded within some predetermined length of time. One example of the use of the WAIT function is in Computer-Aided Instruction applications where one measure of student performance is his "think time." If he takes more than 5 seconds, for example, to respond to a question, the computer can restate the question in another manner, and record the delay as one element of his overall performance.

An additional feature provides year, month, day, and time-of-day information to the RSTS-11 program.

file handling

input-output capability

Small computer timesharing does not imply a reduced need for file handling capability. RSTS-11 supports a broad range of peripheral devices with costs and characteristics suitable for a variety of problems. Each peripheral device may be directly accessed by a terminal user to help him solve his problem in the most effective manner:

- Low-speed paper tape at ASR Teletype terminals for short or infrequently used programs and data.
- High-speed paper tape reader and punch for somewhat larger files.
- Industry-compatible DEC Magtape and inexpensive, high-performance DECtape for unlimited program and data file storage. Low-cost reels of DECtape offer many benefits over punched cards for off-line file storage: faster input/output, reduced storage space, ease of handling, and increased reliability.
- DECpack removable disk cartridge drives, DECdisk fast-access fixed-head disk units, and removable disk packs with a capability of 32 million bytes, total, for on-line storage of frequently used files.
- Punched-card files may be created off-line for data collection or classroom programming and then entered into RSTS to build data and program files.
- Files may be printed at high speed under terminal user control via a high-speed line printer.

on-line file library

RSTS-11 users may create and have high-speed access to program and data files stored on disk units with total file space of up to 32,000,000 bytes. Files may be created for either sequential or random access processing, depending upon the requirements of a user's application. Up to 12 files may be open and accessible from a single program at any one time. The number of files a user may have stored in the disk library is bounded only by the total system disk capacity and the library demands of other users.

An on-line file library system means that RSTS-11 terminal users have the convenience of almost instant access to any desired file or file item. Terminal users are spared the problems and frustrations of handling paper tape each time a program is to be executed. Many applications such as on-line customer inquiry-response are possible with the large-scale file library system of RSTS-11.

file security

Each terminal user has full control on the degree of privacy he desires for each file he creates. The disk library file directory system, which provides efficient access to files, includes a privacy-protection level which may be set only by the terminal user responsible for creation of the file. Personnel records, for example, can be given absolute protection from all other users. Other levels of protection include access limited to a particular group of users, read only, write only, and public.

running other languages on RSTS-11

To satisfy the need for a variety of programming languages, the RSTS-11 hardware configurations may be used for the development and execution of FORTRAN IV and assembly-language programs using the program development software system, DOS.

PDP-11 FORTRAN includes language compatibility elements that permit transfer of FORTRAN IV programs from other systems such as the IBM 1130 to the PDP-11. The language, which is an ANSI-standard compatible FORTRAN IV, will operate in the minimum RSTS hardware configuration described on page 6. DOS is a disk-resident software system which enables a user to both develop and run his own programs. A series of software modules permits creation, debugging and editing of programs with a series of simple commands. During the program run, the monitor furnishes all the I/O device routines, loaders and basic resources accounting necessary from disk resident files. Additional features of DOS include random access and sequential files, file protection for user privacy, simultaneous use of input/output devices with processing and input/output device independence.

digital equipment corporation and its timesharing experience

Your decision to buy a minicomputer timesharing system is an important one. The company behind the system is important too.

Digital Equipment Corporation is the world's largest and most experienced manufacturer of small computer systems. Over 11,000 Digital small computers are now in use performing a large variety of tasks. Digital has a network of sales, support, and field service offices throughout the United States, Europe, Canada, The United Kingdom, Australia, and Japan. These offices are prepared to respond quickly to your needs for training, programming assistance, and maintenance.

Digital produced the first minicomputer timesharing system—TSS-8, a 16-user system based on the popular PDP-8 computer. The features built into RSTS-11 reflect Digital's experience in responding to the needs of the many owners and users of TSS-8 in schools, research and development organizations and timesharing utilities. The developers of TSS-8 system software participated in the development of RSTS-11. You benefit from Digital's knowledge about minicomputer timesharing.

Digital also produces the 127-user PDP-10 timesharing system, giving you the added benefit of large-scale experience. This background has allowed Digital to produce the best medium-scale system— the RSTS-11; one that has many of the best features of both large and small scale systems.

in conclusion

This brochure serves only to introduce you to RSTS-11. If you are interested in more detailed information about RSTS-11 and how it may help meet the needs of your organization, please contact the Digital Equipment Corporation sales office nearest you, or fill out the attached reply card and return it to Digital for more information. A Digital sales engineer will be happy to discuss the use of RSTS-11 in your organization at your convenience.

1972

DIGITAL EQUIPMENT CORPORATION

lab8/e

Prices/Configurations/Master Order Form

digital

LAB-8/E OPTIONS AND COMPONENTS
SPECIFY VOLTAGE AND FREQUENCY
(See PDP8/E Price List for Other Options and General Purpose Peripherals)

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Quantity	Totals Non-discounted	Discounted

BASIC LAB-8/E-05 SYSTEM

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Quantity	Non-discounted	Discounted
PDP8/E-P H945-AA LT33-D AD8-ES VC8-E DK8-ES	Consisting of: 1. Table Top PDP8/E 2. Laboratory Data Panel—Table Top 3. ASR-33 Teletypewriter and Punch 4. 10 Bit A/D Converter ±5V input with front panel and connector 5. 10 Bit Point Plot Display Controller 6. Real-time, Programmable Clock with 3 Schmitt Triggers and Control Panel 7. LAB-8/E Software Kit	None	$ 9,990	—	E	—	105			

ADVANCED LAB-8/E-15 SYSTEM

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Quantity	Non-discounted	Discounted
PDP8/E-N MC8-E PC8-E LT33-C H945-AB VC8-E AD8-EA+AM8-EA +AM8-EC DK8-ES VR14 H960-BB	Consisting of: 1. Rack Mountable PDP8/E (4K Core) 2. 4K Memory Expansion (includes KM8-E) 3. High Speed Paper Tape Reader/Punch 4. KSR-33 Teletypewriter 5. Laboratory Data Panel—Rack Mountable 6. 10 Bit Point Plot Display Controller 7. 10 Bit A/D Converter, 8 Channel Multiplexer with Differential Preamps ±1V input and front panel. Front panel includes parameter knobs and connectors 8. Real-time, Programmable Clock with 3 Schmitt Triggers and Control Panel 9. 7" x 9" Point Plot Display (CRT) 10. 19" Free Standing Cabinet 11. LAB-8/E Software Kit	None	19,990	—	D	—	180			

RT-PS8/E REAL-TIME PROGRAMMING SYSTEM

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Quantity	Non-discounted	Discounted
PDP8/E-N MC8-E PC8-E LT33-C H945-AB VC8-E AD8-EA+AM8-EA +AM8-EC DK8-ES VR14 FPP-12P RK8 KA8-E KD8-E H960-BB	Consisting of: 1. Rack Mountable PDP8/E 2. 4K Memory extension (includes KM8-E) 3. High Speed Paper Tape Reader/Punch 4. KSR-33 Teletypewriter 5. Laboratory Data Panel—Rack Mountable. 6. 10 Bit Point Plot Display Controller 7. 10 Bit A/D Converter, 8 Channel Multiplexer with Differential Preamps ±1V input and front panel. Front panel includes parameter knobs and connectors 8. Real-time, Programmable Clock with 3 Schmitt Triggers and Control Panel 9. 7" x 9" Point Plot Display (CRT) 10. Floating Point Processor (Cabinet Included) 11. Disk Control, Drive and Cartridge (831K Words) (Cabinet Included) 12. External Interface for Positive I/O 13. Data Break (Quantity 2) 14. 19" Free Standing Cabinet 15. LAB-8/E Software Kit	None	44,200	—	D	—	301			

COMPUTERS

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Quantity	Non-discounted	Discounted
PDP8/E-PA (-PB)	Computer, 4K Core Memory and Teletype Control, Table Top Computer.	None	4,990	9	E	—	60			
PDP8/E-NA (-NB)	Rack Mountable	None	4,990	9	G	—	60			

MEMORY OPTIONS

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Quantity	Non-discounted	Discounted
MC8-E	4K Core Memory and Control	PDP8/E	2,750	3	A	150	2			
MM8-E	4K Core Memory	PDP8/E MC8-E	2,500	3	A	150	20			

NOTE: Under "Type No." letters in parenthesis=50 Hz designation.

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Totals	
								Non-discounted	Discounted

PAPER TAPE

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Non-discounted	Discounted
PC8-E (-EA)	High Speed Paper Tape Reader/Punch	PDP8/E	3,900	1	A/B	320	30		

TELETYPES

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Non-discounted	Discounted
LT33-CC (-CD)	KSR-33 Teletypewriter	PDP8/E	1,200	—	F	80	25		
LT33-DC (-DD)	ASR-33 Teletypewriter and Punch	PDP8/E	1,500	—	F	120	30		

LAB MOUNTING BOX

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Non-discounted	Discounted
H945-AA	Table Top DEC Laboratory Data Panel. The front panel accommodates parameter knobs and connectors for A/D's, Real-Time Clock & Schmitt Triggers, and Digital I/O connectors when these options are implemented.	PDP8/E	200	—	E	—	—		
H945-AB	H945-AA—Rack Mountable	PDP8/E	200	—	B	—	—		

ANALOG-TO-DIGITAL CONVERTERS

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Non-discounted	Discounted
AD8-ES**	10 Bit A/D Converter, ±5V input, single ended with connector panel.	PDP8/E	1,100	1	A	100	10		
AD8-EA**	10 Bit A/D Converter, ±5V input, single ended without front panel and connector.	PDP8/E	1,100	1	A	100	10		
AM8-EA	8 Channel Multiplexer with differential preamplifiers ±1V (2 AM8-EA's per LAB-8/E maximum).	AD8-EA	800	2	A	100	10		
AM8-EC	Control panel, connectors and parameter knobs for 16 channels.	AM8-EA H945	250	—	—	40	2		

DISPLAYS

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Non-discounted	Discounted
VC8-E**	10 Bit Point Plot Display Controller	PDP8/E	1,100	1	A	100	10		
VR-14*	7" x 9" Point Plot Display (CRT)	PDP8/E, VC8/E	3,000	—	B	100	18		

REAL-TIME CLOCKS

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Non-discounted	Discounted
DK8-ES	Programmable, real-time clock with 3 Schmitt Triggers and Control Panel	PDP8/E, H945	1,250	2	A	130	5		

DIGITAL INPUT/OUTPUT

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Non-discounted	Discounted
DR8-EC	Digital Input/Output Unit —12 Bits Buffered Input —12 Bits Buffered Output —Connector Panel	PDP8/E, H945	600	1	A	125	6		

MISCELLANEOUS HARDWARE

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Non-discounted	Discounted
)-BB	19" Free Standing Cabinet	None	650	—	—	—	—		
3	Mounting Hardware and Cable for Modified Tektronix 602 Scope (Does not include scope)	PDP8/E, H945, VC8-E	500	—	—	—	—		
BC01-	Cable Assembly for Tektronix 602 Scope	PDP8/E, VC8-E	60	—	—	—	—		

*Rack Mountable: 115 V, A=230 V, B=100 V
Table Top: C=115 V, D=230 V, E=100 V

**Includes Power Supply when required.

MOUNTING CODES

A. Options that plug into the OMNIBUS™, in the PDP8/E or BA8 Expander Box.

B. Mounts in H960-B Basic Cabinet.

C. Mounts in H961A Option Cabinet.

D. Cabinet included in price of option.

E. Requires table space.

F. Requires additional floor space.

G. Requires H960-B cabinet or customer supplied cabinet.

RK8 DISK FILE AND CONTROL	TU56 (Optional)	PC8E
		VR14
	TC08 (Optional)	H945AB
RK8 POWER SUPPLY	FPP12	PDP8/E-N
H961CA OPTION CABINET	H961CA OPTION CABINET	H960BB BASIC CABINET

AM8EC
DK8ES
DR8EC (Optional)

KM8E
MM8E
VC8E
AD8EA
AM8EA
DK8ES
KL8E
DR8EC (Optional)
PC8E

LITERATURE REQUEST

Please send me more detailed information on the new LAB-8/E systems

My application is:_____

_____

_____

☐ I am planning to purchase a computer within six months.

☐ Please have a DIGITAL salesman call me. _____
                                             Area Code   Telephone #

☐ I am updating my reference file.

Please send this literature to:

Name_____ Title_____ _____

Organization_____ Dept. _____ _____

Street _____ _____

City_____ State_____ Zip _____ ___ __

NOTE: Please check here if your organization does not accept THIRD CLASS MAIL. ☐

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Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Quantity	Totals Non-discounted	Discounted

SOFTWARE PRICE

Type No.	Description	Prerequisites	Price	No. Quad Slots Used	Mtg. Code	Field Install.	1 Shift Maint.	Quantity	Non-discounted	Discounted
QFL01-A	PS8 Programming System Supporting Real-Time FORTRAN IV, Disk Cartridge, Applicable Manuals and a 2-Year Update Service included.	RT-PS8/E	1,000	—	—	—	—			

MISCELLANEOUS ITEMS

SPECIAL SYSTEMS (Quote No.   date   )

POWER SPECIFICATIONS
Voltage and Frequency

110–120V/60 Hz ☐

220–230V/50 Hz ☐

SUB-TOTAL, DISCOUNTABLE ITEMS ☐

LESS   % DISCOUNT ☐

TOTAL, DISCOUNTABLE ITEMS ☐

SUB-TOTAL, NON-DISCOUNTABLE ITEMS ☐

SYSTEM TOTAL ☐

INSTALLATION CHARGES ON FIELD-INSTALLED OPTIONS ☐

**IMPORTANT
COMPLETE AND ATTACH
DOMESTIC ORDER SHEET**

1972

NEW LOWER PDP-15 PRICES

Here are the highlights of new PDP-15 products and lower prices. For details consult the new PDP-15 Products and Services Catalog.

INSIDE
* PRICING HIGHLIGHTS
* NEW ME15 MEMORY

digital

EFFECTIVE JULY 1, 1972

PRICING HIGHLIGHTS

96K of ME15 core
on back door of
KP15 cabinet

NEW MEMORY SYSTEM   ME-15

16K word, 18-bit core $14,000

50% less:
   available in 8K blocks or multiples
   $8000 for 8K blocks
   $14,000 for 16K blocks
   Up to 50% less than previous memory!

- Compact—96K words can be installed in CPU cabinet.
- MX15 Multiplexers not needed for expansion above 32K.
- Compatible with MM/MK15 Memory. Can be added to existing PDP-15 systems.
- 980ns Read/Write cycle time.
- All cabinets, cables and power supplies included in these new low prices.

FOUR NEW "BUILDING BLOCK" CONFIGURATIONS

New System	Price	Comparable Price Yesterday	Price Decrease
PDP-15/73	$31,500	$ 45,500	30%
PDP-15/75	$39,000	$ 50,500	23%
PDP-15/77	$69,000	$ 88,100	22%
PDP-15/79	$91,000	$114,900	21%

PDP-15/73: $31,500
- KP15 Central Processor
- 16,384 words ME15 Core Memory
- LA30 DECwriter
- PC15 High-Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- KW15 Real-Time Clock

PDP-15/75: $39,000
- KP15 Central Processor
- 16,384 words ME15 Core Memory
- LA30 DECwriter
- PC15 High-Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- KW15 Real-Time Clock
- TC15 DECtape Control
- TU56 Dual DECtape Transport

PDP-15/77: $69,000
- KP15 Central Processor
- 24,576 words ME15 Core Memory
- LA30 DECwriter
- PC15 High-Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- KW15 Real-Time Clock
- TC15 DECtape Control
- TU56 Dual DECtape Transport
- RF15 DECdisk Control
- RS09 DECdisk Drive, 262,144 words
- KM15 Memory Protect
- KT15 Memory Relocate
- KA15 Automatic Priority Interrupt
- LT15A Single TTY Control

PDP-15/79: $91,000
- KP15 Central Processor
- 16,384 words ME15 Core Memory
- LA30 DECwriter
- PC15 High-Speed Paper Tape Reader and Punch
- KE15 Extended Arithmetic Element
- KW15 Real-Time Clock
- TC59 Magnetic Tape Control
- TU10 Magnetic Tape Transport
- FP15 Floating Point Processor
- RP15 Disk Pack Control
- RP02 Disk Pack Drive

COMPLETE SYSTEMS WITH PROVEN SOFTWARE

BATCH-15 SYSTEM $123,000
15% Less!
- Hardware
  PDP-15/79 Computer System
  LP15J 132-column Line Printer
  CR15D 1000-cpm Card Reader
- Software
  DOS-15 and BOS-15 Software Packages

RSX-PLUS RESOURCE SHARING SYSTEM $85,995
20% Less!
- Hardware
  PDP-15/77 Computer System with 32K ME15 Memory
  VT05 Alphanumeric Terminal
- Software
  DOS-15, RSX-Plus, and RASP-15 Software Packages

PHA-15 PULSE HEIGHT ANALYSIS SYSTEM. . $61,700
18% Less!
- Hardware
  PDP-15/75 with 24K ME15 Memory
  VP15A Storage Tube Display and Control
  NP15 Nuclear Physics Interface
- Software
  Advanced Software System
  PHA-15 Data Analysis and Display Programs
  GASPAN Spectrum Analysis Package
  ISOID Isotope Identification Package

GRAPHIC-15 STARTER SYSTEM. $63,000
17% Less!
- Hardware
  PDP-15/75
  GT15S Graphics Terminal
- Software
  Advanced Software System
  FORTRAN Graphics Package
  Display Editor

GRAPHIC-15 DOS SYSTEM. $78,000
15% Less!
- Hardware
  PDP-15/75
  RS09 Fixed Head Disk
  GT15S Graphics Terminal
- Software
  DOS-15 Software System
  FORTRAN Graphics Package
  Display Editor

GRAPHIC-15 RESOURCE SHARING SYSTEM $107,500
17% Less!
- Hardware
  PDP-15/77 with 32K core
  GT15S Graphics Terminal
- Software
  RSX Plus Software Package
  RSX/Graphics Software Package
   handles up to four terminals for multi-task operation
  DOS software

LOWER PRICES

The existing MM/MK Memory (800-ns) is reduced in price.

Block Size	New Price	Old Price	Price Decrease
1st 4K	$ 8,000	$ 8,000	-
2nd 4K	$ 6,000	$ 6,000	-
8K	$11,000	$14,000	21%
16K	$20,000	$28,000	30%

The existing 15/10, 15/20, 15/30, 15/35, 15/40, and 15/50 systems continue to be offered with the current MM/MK Memory at no change in price.

System	Sell Price
15/10	$ 16,500
15/20	$ 36,000
15/30	$ 59,200
15/35	$ 67,000
15/40	$ 91,000
15/50	$108,900

All peripherals and option prices remain the same except for the RP15 Controller for the RP02.

	Was	Now
RP15	$20,000	$18,000

Some software is unbundled...to allow customers to buy without software if they desire.

a) No charge with purchase of appropriate PDP-15 system:

	Option Number
—Compact Software (papertape)	—
—Advanced Software System (DECtape)	ADS 15-A
—DOS (disk)	DOS 15-A

b) Software to be sold. Prices include documentation, tapes, installation and six-months support.

		Option Number
BOS-15	$2,500	BOS 15-A
RSX-PLUS	$5,000	RSX 15-B
RASP	$1,000	RSP 15-A*
Graphic/RSX	$1,500	RGX 15-A*
ALGOL	$1,000	AGL 15-A

* RSX Plus also required

Note—Customer must purchase appropriate hardware.

Graphics Hardware. Options are grouped to make ordering easier.

GT15-S   Graphic Terminal including VT04 (17-inch display), VT15, VV15, and VL04. Price $24,000

GT15-L   Graphic Terminal. Same as GT15-S but with VT07 (21-inch display) substituted. Price $29,000

Yes, I'd like more PDP-15 information...

Name_____Title_____

Organization_____

Address_____

City_____State_____Zip_____

Telephone_____

Please send me the following new PDP-15 literature.

☐ New price catalog—
   PDP-15 Computer Systems Products and Services

☐ New product overview—
   PDP-15 Computer Systems

☐ RSX PLUS Bulletin—
   Resource Sharing Executive for the PDP-15

☐ Graphic-15/RSX System data sheet—

Your comments please....What can the PDP-15 Product Line do to improve service to you?

_____

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DIGITAL EQUIPMENT CORPORATION

idacs11

INDUSTRIAL DATA ACQUISITION CONTROL SYSTEM

Aug. 1, 1971

Price List - IDACS 11 INDUSTRIAL SYSTEMS

digital

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
PDP-11/20	Computer Consisting of: (1) KA11 Central Processor (1) 4K 16-bit Read/Write Memory (950 ns) (1) Programmer's Console (1) Basic Mounting Box and Power Supply (1) ASR-33 Teletype and Control	None		A	4	0	110		Note 2 Yes
PDP-11/20-AA	Above—rack mountable, slides included 115V 60 Hz		10,800						
PDP-11/20-AB	Same except 230V 50 Hz		10,800						
PDP-11/20-CA	Above—rack mounted, slides and cabinet included 115V 60 Hz		11,450						
PDP-11/20-CB	Same except 230V 50 Hz		11,450						

REAL-TIME SOFTWARE

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
RSX-11C	Real-time core executive, including documentation, training, and support. (See notes on last page.)		2,500	—	—	—	—	—	No

CORE STORAGE

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
MM11-E	4K Words of 16-bit Read/Write Core Memory — 1.2 μs cycle time; includes system unit and Unibus connector	PDP-11/20	3,000	B	1	0	25	150	Note 2 Yes
MM11-F	4K Words of 16-bit Read/Write Core Memory — 950 nsec cycle time; includes systems unit and Unibus connector. Supplied interleaved if ordered in multiples of 8K.	PDP-11/20	3,500	B	1	0	25	150	Note 2 Yes
MM11-H	1K Words of 16-bit Read/Write Core Memory — 950 nsec cycle time; includes system unit and Unibus connector	PDP-11/20	2,500	B	1	—	20	150	Note 2 Yes
MM11-J	2K Words of 16-bit Read/Write Core Memory — 950 nsec cycle time; includes system unit and Unibus connector	PDP-11/20	2,750	B	1	—	23	150	Note 2 Yes
MR11-A	1K Words of 16-bit Read-Only Braid Memory — 350 nanoseconds access time; includes system unit and Unibus connector	PDP-11/20	1,500	B,C	1	0	18	150	Note 2
	Reweaving of MR11-A; includes assembly with diodes	MR11-A	350	B,C	—	—	—	—	Note 2 Yes
	Interleaved Memory... Increases effective memory speed by alternate addressing and overlapping read/write cycles in independent banks of 4K memories. Available in multiples of 8K words.								
MM11-EX	8K Words Interleaved Memory; 900 nsec cycle time.	PDP-11/20	6,000	B	2	0	40	225	Note 2 Yes
MM11-F	8K Words Interleaved Memory; 490 nsec cycle time when transferring into memory; 800 nsec cycle time when transferring out of memory.	PDP-11/20	7,000	B	2	0	40	225	Note 2 Yes

DIODE MEMORY

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
M792	32-Word Read-Only Diode Memory; customer programmable by the removal of selected diodes	PDP-11/20	300	G	0	1	—	—	Note 3 No
BM792-YA	Paper-tape (TTY or a High-Speed Reader) Bootstrap Loader	PDP-11/20	300	G	0	1	3	50	Note 2 Yes
BM792-YB	Bulk Storage Bootstrap Loader	PDP-11/20	300	G	0	1	3	50	Note 2 Yes

MAGNETIC TAPE

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
TC11	Controller for up to Four TU56 Dual DECtape Transports	PDP-11/20	4,000	H	—	—	12	240	Note 2 Yes
TU56	Dual DECtape Transport 115/230V, 50/60 Hz	TC-11	4,700	H	—	—	22	60	Note 2 Yes
TU56-H	Single DECtape Transport 115/230V, 50/60 Hz	TC-11 TU-56 See Note 4	3,500	H	—	—	12	60	Note 2 Yes

INDUSTRY-COMPATIBLE MAGNETIC TAPE

TM11/TU10 — Vacuum-column buffered Tape Transport and Control for either 7- or 9-channel, 1/2-inch industry-compatible magnetic tape: 800 BPI, 45 IPS (7-channel model also has provision for 556 and 200 BPI, program selectable). Up to seven additional slave tape transports may be added. Cabinet included.

The following configurations are available:

Control Unit	115V, 60Hz	115V, 50Hz	230V, 60Hz	230V, 50Hz
	TM11-A	TM11-A	TM11-B	TM11-B
9-track Master Transport	TU10-EA	TU10-EB	TU10-EC	TU10-ED
9-track Slave Transport	TU10-EE	TU10-EF	TU10-EH	TU10-EJ
7-track Master Transport	TU10-FA	TU10-FB	TU10-FC	TU10-FD
7-track Slave Transport	TU10-FE	TU10-FF	TU10-FH	TU10-FJ

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
TU10	7 or 9-Channel, Master or Slave Transport (select model designation from above).	PDP-11/20 TM11	6,950	I	—	—	70	400	Note 2 Yes
TM11	Tape Controller for up to eight TU10 Transports (select model designation from above).	PDP-11/20	3,000	I	—	—	25	240	Note 2 Yes

		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
ROTATING MEMORY									
RS11	256K Word Fixed-Head Disk Drive; 16 μsec/word transfer; 17 msec average access time	RF11	9,000	I	—	—	40	240	Note 2 Yes
RF11	Controller for up to 8 RS11 Disks (includes cabinet)	PDP-11/20	5,000	I	—	—	25	220	Note 2 Yes
RS11-A	Same as above; 230V, 50Hz.	PDP-11/20 RF11	9,000	I	—	—	40	240	Note 2 Yes
RK02	600K-Word DECpack Removable Disk Cartridge System. 22.16 usec/word transfer rate; 80 msec average access time; Expandable to 4.8 million words.	PDP-11/20 RK11	7,000	I	—	—	60	260	No
RK02-A	Same as above; for 230V, 50Hz	PDP-11/20 RK11	7,000	I	—	—	60	260	No
RK02-KA	600K-Word Disk Cartridge for the RK02 Moving-Head Disk	RK11/RK02	135						No
RK03	1.2 million word DECpack Removable Disk Cartridge System. 11.08 μsec/word transfer rate; 80 msec average access time. Expandable to 9.6 million words.	PDP-11/20 RK11	8,000	I	—	—	60	260	No
RK03-A	Same as above; for 230V, 50Hz	PDP-11/20 RK11	8,000	I	—	—	60	260	No
RK03-KA	1.2M-Word Disk Cartridge for the RK03 Moving-Head Disk	RK11/RK03	150						No
RK11	Controller for up to 8 RK02 or RK03 DECpack disk cartridge drives. (Includes cabinet for up to 4 drives).	PDP-11/20	5,900	I	—	—	40	240	Note 2 Yes
RS64	64K-Word DECdisk Fixed-Head Disk Drive; 16 usec/word transfer rate; 16.1 msec average access time. Expandable to 262K words. (Does not include cabinet)	PDP-11/20 RC11	4,500	H	—	—	15	240	Note 2 Yes
RS64-A	Same as above; for 230V, 50Hz.	PDP-11/20 RC11	4,500	H	—	—	15	240	Note 2 Yes
RC11	Controller for up to four RS64 DECdisks.	PDP-11/20	2,450	H	—	—	20	150	Note 2 Yes
EXTENDED ARITHMETIC ELEMENT									
KE11-A	Extended Arithmetic Hardware Element; Multiply, Divide, multiple shifts, normalizes — handles **signed** numbers	PDP-11/20	1,800	B	1	0	10	80	Note 2 Yes
CARD EQUIPMENT									
CR11	Card Reader; for 80-column punched cards; rate 200 cards per minute (table top)	PDP-11/20	4,500	G	—	1	50	240	No
CR11-A	230V, 50 Hz model	PDP-11/20	4,500	G	—	1	50	240	No
CLOCKS									
KW11-L	Real Time Clock — Line Frequency. Causes interrupt each 16.6 ms (60Hz) or 20 ms (50Hz)	PDP-11/20	250	D	0	0	3	50	Note 2 Yes
KW11-P	Programmable Real Time Clock — Provides programmed realtime interval interrupts and interval counting. Program selectable count rates at 100 KHz, 10 KHz, line frequency or from external analog source. Interrupt interval is established by loading a register with a count, selecting the count rate counting down to zero, and then generating an interrupt.	PDP-11/20	600	G	—	1	3	50	Note 2 Yes
PAPER TAPE AND TELETYPE				(See Note 1)					
PC11	High Speed Paper Tape Reader (300 cps) and Punch (50 cps) with control 115V 60 Hz	PDP-11/20	3,900	G	0	1	25	300	Note 2 Yes
PC11-A	Same as PC11 except that it requires 115V 50 Hz 230V requires H-722	PDP-11/20	3,900	G	0	1	25	300	Note 2 Yes
PR11	High Speed Paper Tape Reader (300 cps) with Control 115V 50/60 Hz 230V requires H-722	PDP-11/20	2,400	G	0	1	15	150	Note 2 Yes
H-722	Transformer 230V to 115V 50/60 Hz required for 230V operation of PC11 and PR11	PC11 or PR11	100	E	—	—	—	—	Note 2 Yes
LA30-PA	DECwriter Data Terminal. 30-character per second low-cost data terminal. Hard copy original plus one copy on standard 9-7/8" tractor-driven paper. Extremely low noise; very high reliability. Parallel input & output. 115V, 60Hz	LC11-A	2,795	—	—	—	30	120	Note 2 Yes
LA30-PD	Same as above; for 230V, 50Hz								

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements Module Mounting	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
LC11-A	Controller for LA30 DECwriter	PDP-11/20	400	G	—	1	6	60	Note 2 Yes
KL11-A	Teletype Control for LT33 or LT35 including address select and interrupt control	PDP-11/20	400	G	0	1	6	60	Note 2 Yes
LT33-DC	ASR-33 Teletype 115V 60 Hz	KL11A	1,500	—	—	—	30	120	No
LT33-DD	ASR-33 Teletype 230V 50 Hz	KL11A	1,500	—	—	—	30	120	No
LT33-CC	KSR-33 Teletype 115V 60 Hz	KL11A	1,200	—	—	—	25	80	No
LT33-CD	KSR-33 Teletype 230V 50 Hz	KL11A	1,200	—	—	—	25	80	No
LT35-DC	ASR-35 Teletype 115V 60 Hz	KL11A	4,500	—	—	—	25	150	No
LT35-DD	ASR-35 Teletype 230V 50 Hz	KL11A	4,500	—	—	—	25	150	No
LT35-CC	KSR-35 Teletype 115V 60 Hz	KL11A	3,000	—	—	—	22	80	No
LT35-CD	KSR-35 Teletype 230V 50 Hz	KL11A	3,000	—	—	—	22	80	No

LINE PRINTERS

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements Module Mounting	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
LP11	300 lpm, line printer includes control logic	PDP-11/20		F,G	0	1	75	200	No
LP11-FA	80 Col. Line Printer, 64 Char. 115V 60 Hz	"	12,000	—	—	—	—	—	—
LP11-FB	80 Col. Line Printer, 64 Char. 230V 50 Hz	"	12,000	—	—	—	—	—	—
LP11-HA	80 Col. Line Printer, 96 Char. 115V 60 Hz	"	13,500	—	—	—	—	—	—
LP11-HB	80 Col. Line Printer, 96 Char. 230V 50 Hz	"	13,500	—	—	—	—	—	—
LP11-JA	132 Col. Line Printer, 64 Char. 115V 60 Hz	"	17,500	—	—	—	—	—	—
LP11-JB	132 Col. Line Printer, 64 Char. 230V 50 Hz	"	17,500	—	—	—	—	—	—
LP11-KA	132 Col. Line Printer, 96 Char. 115V 60 Hz	"	19,000	—	—	—	—	—	—
LP11-KB	132 Col. Line Printer, 96 Char. 230V 50 Hz	"	19,000	—	—	—	—	—	—

ANALOG TO DIGITAL CONVERTER (High Level)

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements Module Mounting	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
AD01-D	Analog to Digital Conversion Subsystem. 10 bit unipolar or 10 bit plus sign (optional) analog to digital converter, multiplexer control for up to 32 channels of single-ended, high-level inputs; with interface and power supply. Program selectable input ranges of: 0 to +1.25V, +2.5V, +5.0 or +10.0V unipolar; 0 to ±1.25V, ±2.5V, ±10.0V bipolar.	PDP-11/20	2,400	H	0	—	20	150	Note 2 Yes
A124	Mux Module 4 channels	AD01-D	60	—	—	—	2	20	Note 2 Yes
AH04	Sample & Hold	AD01-D	300	—	—	—	3	50	Note 2 Yes
AH05	Sign Bit, 11th Bit, 2's complement	AD01-D	400	—	—	—	6	80	Note 2 Yes

ANALOG TO DIGITAL CONVERTER (Low Level)

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements Module Mounting	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
AFC11	AFC11 low-level, differential analog input subsystem. Master File—basic AFC11 system file contains interface and control, 13-bit A/D converter, programmable gain amplifier and provision for mounting up to 32 channels for multiplexing, includes I/O cable and analog power supply. (Master file may be expanded to 128 channels by addition of three AM07-B file units and the appropriate number of signal conditioning and multiplexing modules).	H964 series cabinet and PDP-11/20	5,500	—	—	—	39	90	No
AFC8X (A or B)	Expander File provides programmable gain amplifier file isolation, connector cable to previous file, provision for mounting 32 channels of multiplexing/signal conditioning, and provision for five additional AM07-B file units. Total expander file capacity is 192 channels. Model numbers: AFC8XA—second or third file in electronics cabinets; AFC8XB—first file in second electronics cabinet.	Master File	1,900	—	—	—	20	95	No
AM07-B	File Units—provide address decoding, control logic and capacity for mounting up to 32 channels. Requires four eight-channel multiplexer/signal conditioning modules for full implementation.	AFC11 Master File, Expander File	300	—	—	—	3	30	No
BA150	Eight-channel flying capacitor Multiplexer Module. Each master file, expander file, and AM07-B file unit accommodates up to four multiplexer modules (32 channels).	Master File Expander Files AM07-B File Units	300	—	—	—	4	40 Note 5	No
BA90	Eight-channel Signal Conditioning Modules (one required per BA150). Provides filtering, scaling, or attenuation, and connection to screw terminal/cable assembly. Model numbers: BA903—direct signal conditioning module; BA904—Voltage/Voltage Signal Conditioning Module; BA905—Current/Voltage Signal Conditioning Module.	BA150 Multiplexer Module	40 (BA903) 150 (BA904) 80 (BA905)	—	—	—	4	—	No
BC90C	Screw terminal/cable assembly provides screw terminal connectors for 16 pairs of input field wiring. Connects to two eight-channel Signal Conditioning Modules.	Two eight-channel Signal Conditioning Modules	80	—	—	—	—	—	No

DIGITAL TO ANALOG CONVERTER *

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
AA11-D	Digital-to-analog conversion subsystem. Includes interface control (and separate power supply) for up to four D/A converters (BA614) plus optional scope control.	PDP-11/20	1,000	B	1	0	6	10	Note 2 Yes
BA614	Digital-to-analog converter. Twelve-bit bipolar converter module includes converter, output amplifier, and reference voltage source. (Up to four per AA11-D.)	AA11-D	375	—	—	—	5	30	Note 2 Yes
AA11-A	Scope control for Tektronix 611 storage display unit.	AA11-D and two BA614's	600	—	—	—	4	20	Note 2 Yes
AA11-B	Scope control for Tektronix RM503 oscilloscope.	AA11-D and two BA614's	600	—	—	—	4	20	Note 2 Yes
AA11-C	Scope control for VR12 point plotting display.	AA11-D and two BA614's	600	—	—	—	4	20	Note 2 Yes

* See also UDC11

DIGITAL INPUT/OUTPUT SUBSYSTEM

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
UDC11	Master File—basic UDC11 system file contains interface and control, address/scan register, and provision for installing four functional I/O modules (64 digital points) and I/O cable. Master File may be expanded to 16 digital words (256 digital points) by adding three DD02 file units and appropriate number of functional I/O and signal conditioning modules.	H964 series cabinet and PDP-11/20	2,600	—	—	—	10	60	No
UDC8X	Expander File contains mounting hardware, file I/O cable and provision for installing four digital words and up to five DD02 file units each capable of containing four digital words. (Fully implemented expander file contains 24 functional I/O modules — 24 digital words or 384 digital points). Model numbers: UDC8XA—second or third file in electronics cabinets; UDC8XB—first file in each additional electronics cabinet.	UDC11 Master File plus H964C Dual Cabinet	500	—	—	—	3	25	No
DD02	File units provide address decoding, control logic and capacity for mounting up to four functional I/O and signal conditioning modules (four digital words or 64 digital points).	UDC11 Master File Expander Files	300	—	—	—	2	20	No
BW731	Contact sense functional I/O module	Master File	160	—	—	—	—	—	No
BW733	Contact interrupt functional I/O module	Expander Files DD02 file units	375	—	—	—	2	15 Note 5	No
BM687	Single-shot driver functional I/O module		335	—	—	—	2	10 Note 5	No
BM807	Single-shot relay functional I/O module		640	—	—	—	2	10 Note 5	No
BM685	Flip-flop driver functional I/O module		160	—	—	—	1	4 Note 5	No
BM805	Flip-flop relay functional I/O module		535	—	—	—	2	4 Note 5	No
BM803	Latching relay functional I/O module		615	—	—	—	2	4 Note 5	No
BW734	I/O counter		350	—	—	—	2	4 Note 5	No
BW400	Isolated power signal conditioning module	BW731, BW733, BW134, BM803, BM805, BM807	40	—	—	—	—	—	No
BW402	Common power signal conditioning module		40	—	—	—	—	—	No
BW403	Driver output signal conditioning module	BM685, BM687	40	—	—	—	—	—	No
BA633	D/A output (four channels of ten-bit D/A)	H738A and BA233, BA234, BA235 or BA236	480	—	—	—	6	40 Note 5	No
BA233	Voltage output (0 to +10V) signal conditioning module	BA633	200	—	—	—	2	10 Note 5	No

DIGITAL INPUT/OUTPUT SUBSYSTEM (CON'T)

Type Number		Prerequisites	Price	Mounting Code	System Units	Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
BA234	Voltage output (+1 to +5V) signal conditioning module	BA633	200	—	—	—		2	10 Note 5	No
BA235	Current output (4 to 20MA) signal conditioning module	BA633	330	—	—	—		2	10 Note 5	No
BA236	Current output (10 to 50MA) signal conditioning module	BA633	330	—	—	—		2	10 Note 5	No
BC40C-4	Screw terminal/cable assembly		60	—	—	—		—	—	No
H738A	Power supply. Handles up to 16 channels (Maximum of four BA633's).	BA633	500	—	—	—		1	5	No

CRT DISPLAYS

Type Number		Prerequisites	Price	Mounting Code	System Units	Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
VT01-A	Tektronix 611 Storage Tube Display	AA11-D AA11-A + (2) BA614	3,000	—	—	—		66	60	No
VR01A	Tektronix RM503 Oscilliscope Display	AA11-D+ AA11-B+ (2) BA614	1,000	H	—	—		14	90	No
VR14	7" x 9" Point Plot Display	AA11-D+ AA11-C+ (2) BA614	3,000	H	—	—		18	100	No
VR14A	Same except 230V, 50/60 Hz	AA11-D+ AA11-C+ (2) BA614	3,000	H	—	—		18	100	No
AA11-A	Control for 611 scope. Space available for 2 more BA614; mounts in AA11-D.	AA11-D+ (2) BA614	600	—	—	—		4	20	Note 2 Yes
AA11-B	Control for RM503 Scope. Space available for 2 more BA614; mounts in AA11-D	AA11-D+ (2) BA614	600	—	—	—		4	20	Note 2 Yes
AA11-C	Control for VR12 Scope. Space available for 2 more BA614; mounts in AA11-D	AA11-D (2) BA614	600	—	—	—		4	20	Note 2 Yes
AA11-D	Digital to Analog Control with space available for one scope control.	PDP-11/20	1,000	B	1	0		6	15	Note 2 Yes
BA614	Digital to Analog Converter; mounts in AA11-D.	AA11-D	375	—	—	—		5	30	Note 2 Yes

LOCAL CRT TERMINALS

Type Number		Prerequisites	Price	Mounting Code	System Units	Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
VT06	Alphanumeric CRT visual display terminal with keyboard. Half or full duplex, 110 Baud to 2400 Baud switch selectable.— table top model	DE11-A + KL11-E or DC11-A + DC11-DA + H312A	3,950	—	—	—		35	60	No
VT05-A	Alphanumeric CRT display with keyboard. Half-or full-duplex, 64/128 character set keyboard, 20 lines of 72 characters per line on screen size of 8-3/4" x 6-5/8". Totally Teletype compatible at 110, 150, or 300 Baud. 115V, 60Hz.	PDP-11/20 KL11-A,B,C or DC11	2,795	—	—	—		20	80	Note 2 Yes
VT05-D	Same as above; for 230V, 50Hz.									

INTERFACE EQUIPMENT

(See Note 1)

Type Number		Prerequisites	Price	Mounting Code	System Units	Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
DR11-A	General-purpose digital interface to the PDP-11, permits bidirectional transfer of 16 bits in parallel from the user's device to the PDP-11 UNIBUS. Contains all necessary interrupt, address, and control signals to allow the user to interface directly to the PDP-11. Includes cable connectors	PDP-11/20	400	G	0	1		5	—	Note 3 No
DR11-B	General-purpose, direct-memory access interface to PDP-11. Moves data directly to or from users device to memory at DMA speeds. Includes word count, current address, and data registers. Can also be used for high-speed processor-to-processor communication.	PDP-11/20	1,200	B	1	0		10	100	Note 2 Yes
DD11-A	Peripheral Mounting Panel (includes UNIBUS Connector Module—M920) Prewired System Unit for 4 small peripheral controllers (one System Unit).	PDP-11/20	175	B	1	—		—	50	Note 2 Yes
BB11	Blank Mounting Panel—Wired for bus and power (Does not include UNIBUS connector Module—M920) For custom interface design and mounting System Units.	None	90	B	1	—		—	50	Note 3 No

Note: Factory testing is provided for any controller or interface purchased without its accompanying peripheral. No field testing will be performed.

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status

INTERFACE EQUIPMENT (CON'T)

Type Number	Description	Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
DB11-A	UNIBUS Repeater. Allows an additional 18 unit loads and an additional 50 feet of UNIBUS extension to be added to the PDP-11 system. (only one DB11-A can be added to a system).	PDP-11/20	1,000	B	1	0	5	75	Note 2 Yes
M783	UNIBUS Transmitter Module; UNIBUS to Device interface drivers, (12 drivers)	None	30	—	—	—	—	—	Note 3 No
M784	UNIBUS Receiver Module; UNIBUS to Device interface receivers, (16 receivers)	None	30	—	—	—	—	—	Note 3 No
M785	UNIBUS Transceiver Module; UNIBUS/Device interface drivers and receivers (8 receivers and 8 drivers)	None	35	—	—	—	—	—	Note 3 No
M786	General-Purpose Interface Module containing 16-bit Flip-Flop Register with bus receivers and transmitters	None	220	—	—	—	—	—	Note 3 No
M105	Address Selector Module (4 Addresses)	None	65	—	—	—	—	—	Note 3 No
M782	Interrupt Control Module (2 interrupt capability)	None	100	—	—	—	—	—	Note 3 No
M920	UNIBUS Connector Module (Jumper module to interconnect System Units)	None	45	—	—	—	—	—	Note 3 No
BC11A	UNIBUS Cable	None							Note 3 No
BC11A-2	2'		90	—	—	—	—	—	
BC11A-5	5'		100	—	—	—	—	—	
BC11A-8F	8'6"		105	—	—	—	—	—	
BC11A-10	10'		110	—	—	—	—	—	
BC11A-15	15'		125	—	—	—	—	—	
BC11A-25	25'		160	—	—	—	—	—	

COMMUNICATIONS

ASYNCHRONOUS INTERFACES

Type Number	Description	Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
KL11-A	Full Duplex Asynchronous Line Interface Unit; 110 Baud.	PDP-11/20	400	G	0	1	6	60	Note 2 Yes
KL11-B	Full Duplex Asynchronous Line Interface Unit; 150 Baud	PDP-11/20	400	G	0	1	6	60	Note 2 Yes
KL11-C	Same as KL11-B, except 300 Baud	PDP-11/20	400	G	0	1	6	60	Note 2 Yes
KL11-D	Same as KL11-B, except 600 Baud	PDP-11/20	400	G	0	1	6	60	Note 2 Yes
KL11-E	Same as KL11-B, except 1200 Baud send, 110 Baud receive	PDP-11/20	400	G	0	1	6	60	Note 2 Yes
KL11-F	Same as KL11-B, except 2400 Baud	PDP-11/20	400	G	0	1	6	60	Note 2 Yes
DE11-A	EIA level, RS-232-C line adaptor for VT06 or other EIA level devices (Requires KL11 interface). Mounts on KL11.	KL11 series interfaces	100	—	—	—	2	20	Note 2 Yes
DC11-AA	Dual Asynchronous Serial Line System Unit and Clock for mounting 2 DC11DA Module Sets. 110, 134.5, 150, 300 Baud (typical speeds with 103 modem, program selectable)	PDP-11/20	250	B	1	0	3	50	Note 2 Yes
DC11-AB	Same as DC11-AA except 110, 300, 1200 and 1800 Baud (typical 202 speeds, program selectable).	PDP-11/20	250	B	1	0	3	50	Note 2 Yes
DC11-AC	Same as DC11AA except 110, 150, 600 and 1200 Baud (typical European, program selectable)	PDP-11/20	250	B	1	0	3	50	Note 2 Yes
DC11-AD	Same as DC11-AA except 50, 110, 134.5, 150 Baud.	PDP-11/20	350	B	1	0	3	50	Note 2 Yes
DC11-AE	Same as DC11-AA except 75, 110, 134.5, 150 Baud.	PDP-11/20	350	B	1	0	3	50	Note 2 Yes
DC11-AG	Same as DC11-AA except 134.5, 150, 300, 1200 Baud	PDP-11/20	250	B	1	0	3	50	Note 2 Yes
DC11-AH	Same as DC11-AA except 110, 134.5, 600, 1200 Baud.	PDP-11/20	250	B	1	0	3	50	Note 2 Yes
DC11-AX	Same as DC11-AA except 110, 134.5, 150 Baud plus one non-standard Baud rate above 600 Baud.	PDP-11/20	350	B	1	0	3	50	Note 2 Yes

Note: Factory testing is provided for any controller or interface purchased without its accompanying peripheral. No field testing will be performed.

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
DC11-DA	Full Duplex Serial Module Set for DC11-A (DC11-A accommodates 2 ea.) with EIA/CCITT termination suitable for direct use with 103 or 202 modems. Handles 5, 6, 7 or 8 bit codes with 1 or 2 stop bits.	Any DC11-A	600	—	—	—	7	50	Note 2 Yes
H312A	Asynchronous Null Modem—allows direct connection of any peripheral having an EIA 232 interface. Mounts DC11-DA, DP11-DA or DM11-DB. Note: DP11-KA required with DP11-DA.		60	—	—	—	—	50	Note 3 No
DM11-AA	Asynchronous 16-Line Single Speed Multiplexer and Mounting Panel. Includes space for mounting up to 4 line adapters (16 line interfaces). Order must specify the Baud rate (up to 1200 Baud for 16 lines). If no speed is specified, 110 Baud will be supplied. (115V).	PDP-11/20	3,200	B	2	—	30	175	Note 2 Yes
DM11-AC	Same as above; for 230V, 50Hz.	PDP-11/20	3,200	B	2	—	30	175	Note 2 Yes
DM11-DA	Line adapter which implements four Teletype lines (data only).	DM11-AA	150	J	—	—	5	40	Note 2 Yes
DM11-DB	Line adapter which implements four EIA lines (data only). Includes four 25' modem cables.	DM11-AA	450	J	—	—	10	40	Note 2 Yes

SYNCHRONOUS INTERFACES

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
DP11-DA	Full/Half Duplex Synchronous Line Module Set and System Unit. Double buffered. EIA/CCITT termination suitable for direct use with 201 modems. Includes 25' modem cable. Space available for one DP11-CA or DP11-KA.	PDP-11/20	1,400	B	1	—	18	125	Note 2 Yes
DP11-DC	Same as above except suitable for direct use with 303 modems. Includes 25' modem cable. Space available for one DP11-CA or DP11-KA	PDP-11/20	1,800	B	1	—	18	125	Note 2
DP11-CA	Data/Sync Register Extender. Adds the ability to handle 10-, 11-, and 12-bit data characters. Mounts in DP11.	DP11-DA or DP11-DC	300	—	—	—	3	50	Note 2 Yes
DP11-KA	Internal Clock. Clocking source to be used for direct connection of DP11 to local synchronous terminal or a local synchronous computer interface (without modems). For following Baud rates: 2400, 4800, 9600, 19.2K and 40.8K. Baud rate must be specified. Mounts in DP11.	DP11-DA or DP11-DC	200	—	—	—	3	50	Note 2 Yes

AUTO DIAL INTERFACES

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
DN11-AA	Prewired system unit for four Bell 801 Automatic Calling Unit Interfaces. Includes 25' cable.	PDP-11/20	300	B	1	—	5	70	Note 2 Yes
DN11-DA	Module set for the DN11-AA, Interfaces directly with Bell 801 ACU. Includes 25' cable (up to 4 DN11-DA's can be mounted in each DN11-AA).	DN11-AA	400	—	0	1	3	50	Note 2 Yes

MOUNTING BOXES AND POWER SUPPLIES

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
BA11-EC	Extension Mounting Box with **Table Top Cover.** Includes a fan and BC11A-8F UNIBUS Cable	None	450	—	—	—	—	60	Note 2 Yes
BA11-ES	Extension Mounting Box with **Tilt and Lock Chassis Slides.** Includes fans and BC11A-8F UNIBUS Cable	None	400	—	—	—	—	60	Note 2 Yes
H964A	Single cabinet for AFC11 or UDC11—contains logic power supply, cooling fans, and filters. Screw terminals that mount in the same cabinet require separate mechanical assembly (model H964MA). Bottom entry only of field cables. Model numbers: H964AA—115-volt power supply; H964AB—230-volt power supply. (Limited to one master file of AFC or UDC **only.**) For top entry, order model number H964P.	—	1,400	—	—	—	2	30	No
H964MA	Mechanical assembly for mounting screw terminals.	H964AA or H964AB single cabinet	75	—	—	—	—	—	No
H964P	Mechanical assembly to permit top entry of field cables.	H964AA or H964AB cabinet	150	—	—	—	—	—	No
H964C	Dual cabinet for AFC11/UDC11. One cabinet houses system electronics and logic (contains logic power supplies, cooling fans, and filters). Second cabinet is for termination of input field wiring on screw terminals. Model numbers: H964CA—top or bottom entry of field cables, 115 volts; H964CB—bottom entry only of field cables, 115 volts; H964CC—top or bottom entry of field cables, 230 volts; H964CD—bottom entry only of field cables, 230 volts. (Limited to maximum of three files of AFC/UDC or mix.)	—	2,000	—	—	—	2	70	No
H720-E	Power Supply 115V 50/60 Hz	None	600	B	—	—	—	—	Note 2 Yes

Note: Factory testing is provided for any controller or interface purchased without its accompanying peripheral. No field testing will be performed.

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
H720-F	Power Supply 230V 50/60 Hz	None	600	B	—	—	—	—	Note 2 Yes
H960-CA	Free Standing Base Cabinet. Includes fans, power distribution panel, extension feet, front bezel panels	None	650	—	—	—	—	—	Note 2 Yes
H952-HA	Free Standing Table with adjustable height legs for use with H960-CA cabinet	None	120	—	—	—	—	—	Note 2 Yes
H961-A	Free Standing Cabinet without end panels	None	430	—	—	—	—	—	Note 2 Yes

MAINTENANCE AND SPARE PARTS

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
KM11A	Maintenance Module — light and switch card for examination of machine states	None	250	—	—	—	—	—	Note 2 Yes

5509081-0-1	Transparent overlay to KM11 to check out the KE11-A Extended Arithmetic Element.
5509181-0-3	Same as above, for RK11, RK02/RK03 Moving-Head Disk
5509181-0-5	Same as above, for TM11/TU10 Mag Tape Unit
	Price: $5.00 each

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
SP11-KA	KA11 Spare Parts	PDP-11/20	2,950	—	—	—	—	—	Note 2 Yes
SP11-MM	MM11-E Spare Parts	PDP-11/20	700	—	—	—	—	—	Note 2 Yes
SP11-PS	Spare Parts for H720	H720	195	—	—	—	—	—	Note 2 Yes

MOUNTING CODES

A — Mounts in Basic Mounting Box

B — Mounts in Basic or Extension Mounting Box

C — One MR11-A mounts in a single System Unit which is included with the purchase of the MR11-A option. Each MR11-A requires one System Unit of mounting space.

D — Mounts in the KA11 Processor

E — Mounts on rear door of H960-CA or similar cabinet

F — Line Printer free-standing HWD (inches)=46 x 24 x 22

G — Mounts in one of the two small peripheral controller slots in the KA-11 or one of the four small peripheral controller slots in a DD11-A.

H — Cabinet Mounted

I — Cabinet Mounted; cabinet included in price of option

J — Mounts in 5" rack panel (provided with DM11-AA).

Note 1

When ordering PDP-11 systems it is important that sufficient mounting hardware is ordered to accommodate each system. Particular attention should be given to the number of DD11's required and whether a BA11-EC or BA11-ES Extension Mounting Box is needed.

DD11's are System Units prewired to mount small peripheral controllers such as a Teletype control or a High Speed Paper Tape Reader/Punch control. Each DD11 can hold four controllers and mounts in 1/6 of a Basic or Extension Mounting Box. This is in addition to the two small peripheral controller slots available in the KA-11.

To determine the number of DD11's to order, total the number of spaces required for each item ordered times the quantity ordered. Subtract two from this number and divide by four. Round up to the next whole number if there is a remainder. Order this number of DD11's.

$$\frac{\text{\# of "Spaces" used} - 2}{4} = \text{\# of DD11's needed} \quad \text{Note: Round up to a whole number}$$

Six System Units will mount in either the Basic or the Extension Mounting Box. To determine whether to order an Extension Mounting Box, total the products of the number of System Units required for each item ordered times the quantity ordered. Include DD11's and BB11's. Add one and divide the new total by six and round up to the next whole number if there is a remainder. If the result is one, an Extension Mounting Box is not needed. If the result is two, order an Extension Mounting Box (BA11-ES or BA11-EC) and Power Supply (H720A or H720B).

$$\frac{\text{\# of System Units used}}{6} = \text{\# of Mounting Boxes Required}$$

Note: Round up to a whole number. If the result is greater than one an Extension Mounting Box is needed.

Note 2

Discountable under a PDP-11 Discount Agreement.

Available from Module Sales; subject to Module Sales discount agreement.

Note 4

If the TU56-H is purchased alone, without the TU56, DEC is unable to provide software support for the TU56-H.

Note 5

When shipped as part of a complete AFC or UDC subsystem, installation cost will be only 25 per cent of this amount.

SYSTEMS SOFTWARE WITH RECOMMENDED MINIMUM SYSTEM CONFIGURATIONS

DISK OPERATING SYSTEM

The PDP-11 Disk Monitor is a disk-resident software system which enables a PDP-11 user to efficiently develop and execute his programs. During program development, the monitor serves the user by providing a simple, easy-to-use interface with program development software such as the relocating assembler, FORTRAN compiler, editor, etc. During program execution, the monitor eases the burden on the user program by providing common I/O device handling routines, loaders, operator interface, and basic resources accounting. The Disk Operating System offers modular design for extreme flexibility, random access and sequential files, file protection, simultaneous I/O with processing and user access to a complete set of Monitor subsystems.

Typical DOS Configuration

- PDP-11/20, extra 4K core (8K total); with cabinet and Teletype
- RF11/RS11 256K-word DEC Disk and Control
- PC11 High-Speed Paper Tape Reader and Punch
- BM792-YB ROM Bootstrap Loader
        Price: $33,150

RSX-11C REAL-TIME SYSTEM EXECUTIVE

RSX-11C is a software package that coordinates the execution of tasks in a multi-programming mode in the PDP-11 family of computers. RSX-11C provides task scheduling, input-output, operator communication, and other functions required for real-time multi-programmed operation.

User tasks or programs can be written to operate under the control of RSX-11C using either PAL-11 assembler programs or FORTRAN IV programs compiled under the Disk Operating System.

The handling of program scheduling and input-output by the real-time monitor makes it possible to use high-level languages such as FORTRAN IV. Combining FORTRAN IV with a general-purpose real-time executive provides a software environment to make the PDP-11 a practical real-time operational tool for the process engineer, test engineer, or researcher.

Typical Configurations
I. RSX-11C Basic Configuration

PDP-11/20, 12K of core, with Cabinet and Teletype
KW11-L Real-Time Clock
PC11 High-Speed Paper Tape Reader and Punch
        Price: $21,950

RSX-11C Configuration Running FORTRAN (DOS configuration is required for compiling FORTRAN programs)
PDP-11/20, 16K of core, with Cabinet and Teletype
KW11-L Real-Time Clock
PC11 High-Speed Paper Tape Reader and Punch
        Price: $25,450

All prices quoted are FOB Maynard, Massachusetts and apply in the continental United States only. Federal, state, and local taxes are not included.

All prices and specifications are subject to change without notice.

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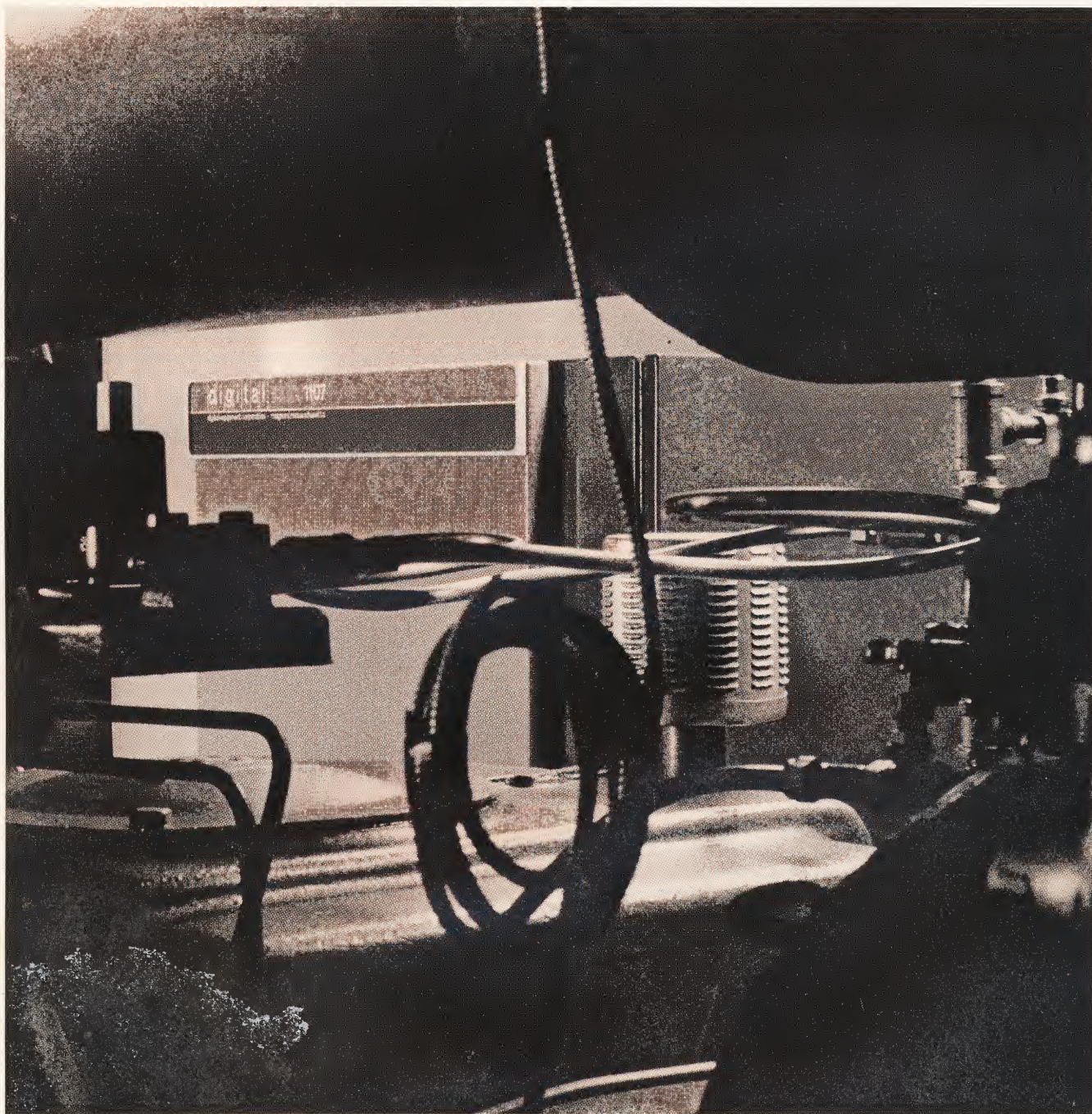Minato-Ku, Tokyo, Japan
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DIGITAL EQUIPMENT CORPORATION

idacs11

INDUSTRIAL PRODUCTS GROUP

March 1, 1972

IDACS 11/07 INDUSTRIAL CONTROL SYSTEM–Price List

digital

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates
IDACS 11/07 CONTROL SYSTEM								
	Basic IDACS 11/07 system includes:	NONE						
	IDACS 11/07 computer consisting of:							
	• KA11 Central Processor (PDP-11/20)							
	• 4K 16-bit Read/Write Memory (950ns)							
	• Programmer's Console							
	• Power Supply							
	• Basic Mounting Box with slides							
	Rugged Industrial System Enclosure including:							
	• Expander Box with slides and wired control assembly for mounting analog and digital controllers (order controllers below).							
	• Power Supplies and Power Control							
	• Heat Exchanger							
11/07AA	Above with Heat Exchanger 115V 60Hz		$21,000	A	4	0	94	—
11/07BA	Above with Air Conditioner 115V 60Hz		22,500	A	4	0	104	—
OPERATOR STATION								
LT33-RA	(ASR-33 with special cable and connector)	11/07	1,500	—	—	—	30	120
KLR11-A	Operator Station Control (110 baud) including address select and interrupt	KLR11-A	850	D	0	1	6	60
DIGITAL INPUT/OUTPUT CONTROLLER								
UDC11/07	Digital Input/Output, and Analog Output Subsystem controller contains interface and control, address/scan register, and provision for installing four functional I/O modules (64 digital points) and I/O cable. UDC11/07 may be expanded within system enclosure to 32 digital words (512 digital points) by adding 7 DD02 file units and the appropriate number of functional I/O modules, signal conditioning modules and screw terminal/cable assemblies.	11/07	2,600	—	—	—	10	60
ANALOG INPUT CONTROLLER								
AFC11/07	Low level differential analog input subsystem controller contains interface and control, 13-bit A/D converter, programmable gain amplifier and provision for mounting 3 BA150 multiplexer boards (24 channels). Included are I/O cable and Analog power supply. AFC11/07 may be expanded to 248 channels by addition of 7 AM07B file units and the appropriate number of signal conditioning modules, multiplexer modules, and screw terminal/cable assemblies.	11/07	5,600	—	—	—	39	90
REAL-TIME SOFTWARE								
RSX-11C	Real-time core executive, including documentation, training, and support. (See notes on last page.)		2,500	—	—	—	—	—
CORE STORAGE								
MM11-E	4K Words of 16-bit Read/Write Core Memory—1.2µs cycle time; includes system unit and Unibus connector	11/07	3,000	B	1	0	25	150
MM11-F	4K Words of 16-bit Read/Write Core Memory—950 nsec cycle time; includes systems unit and Unibus connector. Supplied interleaved if ordered in multiples of 8K.	11/07	3,500	B	1	0	25	150
	Interleaved Memory...Increases effective memory speed by alternate addressing and overlapping read/write cycles in independent banks of 4K memories. Available in multiples of 8K words.							
MM11-EX	8K Words Interleaved Memory; 900 nsec cycle time.	11/07	6,000	B	2	0	40	180
MM11-F	8K Words Interleaved Memory; 490 nsec cycle time when transferring into memory; 800 nsec cycle time when transferring out of memory.	11/07	7,000	B	2	0	40	180
DIODE MEMORY								
M792	32-Word Read-Only Diode Memory; customer programmable by the removal of selected diodes.	11/07	300	G	0	1	3	—
BM792-YA	Paper-tape (TTY or a High-Speed Reader) Bootstrap Loader.	11/07	300	G	0	1	3	50
EXTENDED ARITHMETIC ELEMENT								
KE11-A	Extended Arithmetic Hardware Element; Multiply, Divide, multiple shifts, normalizes—handles **signed** numbers.	11/07	1,800	B	1	0	10	80

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates
CLOCKS								
KW11-L	Real-Time Clock—Line Frequency. Causes interrupt each 16.6 ms (60Hz) or 20 ms (50Hz).	11/07	250	D	0	0	3	50
KW11-P	Programmable Real Time Clock—Provides programmed real-time interval interrupts and interval counting. Program selectable count rates of 100 KHz, 10 KHz, line frequency or from external analog source. Interrupt interval is established by loading a register with a count, selecting the count rate counting down to zero, and then generating an interrupt.	11/07	600	G	—	1	3	50
PCR-11C	High Speed Rdr/Punch with control (portable cabinet).	11/07	4,900	G	0	1	3	50
UDC11/07 OPTIONS								
EXPANDER FILE UNITS								
DD02	UDC11/07 file units provide address decoding, control logic and capacity for mounting up to four functional I/O and signal conditioning modules (four digital words or 64 digital points.)	UDC11/07	300	—	—	—	2	20
DIGITAL FUNCTIONAL I/O MODULES								
BW731	Relay contact sense functional I/O module (requires BW400 or BW402 signal conditioning).	UDC11/07	160	—	—	—	1	4 Note 2
BW733	Relay contact interrupt functional I/O module (requires BW400 or BW402 signal conditioning).	DD02 file units	375	—	—	—	2	4 Note 2
BW741	Solid State Contact Sense (requires BW400 or BW402 signal conditioning).		250	—	—	—	2	15 Note 2
BW743	Solid State Contact Interrupt (requires BW400 or BW402 signal conditioning).		375	—	—	—	2	15 Note 2
BM685	Flip-flop driver (requires BW403 signal conditioning).		160	—	—	—	1	4 Note 2
BM805	Flip-flop relay (requires BW400 or BW402 signal conditioning).		535	—	—	—	2	4 Note 2
BM687	Single-shot driver (requires BW403 signal conditioning).		335	—	—	—	2	10 Note 2
BM807	Single-shot relay (requires BW400 or BW402 signal conditioning).		640	—	—	—	2	10 Note 2
BM803	Latching relay (requires BW400 or BW402 signal conditioning).		615	—	—	—	2	4 Note 2
BW734	I/O counter (requires BW400 signal conditioning).		350	—	—	—	2	4 Note 2
BA633	See Analog Output (below).							
DIGITAL SIGNAL CONDITIONING MODULES								
(1 Required per Digital Functional I/O Module)								
BW400	Isolated power signal conditioning module.	Digital Functional I/O Module	40	—	—	—	—	—
BW402	Common power signal conditioning module.	Digital Functional I/O Module	40	—	—	—	—	—
BW403	Driver output signal conditioning module.	BM685, BM687	40	—	—	—	—	—
ANALOG OUTPUT								
BA633	D/A Output (4 channels of 10-bit D/A plugs in as UDC functional module (requires H738A power supply and signal conditioning module—below)).	H738A and BA233 or BA234 or BA235 or BA236	480	—	—	—	6	40 Note 2
BA233	D/A Signal Conditioning voltage output (0 to +10V).	BA633	200	—	—	—	2	10 Note 2
BA234	D/A Signal Conditioning voltage output (+1 to +5V).	BA633	200	—	—	—	2	10 Note 2
BA235	D/A Signal Conditioning current output (4 to 20 mA).	BA633	330	—	—	—	2	10 Note 2
BA236	D/A Signal Conditioning current output (10 to 50 mA).	BA633	330	—	—	—	2	10 Note 2
H738A	D/A Power Supply, one required for each 16 channels (up to 4 BA633's).	BA633	500	—	—	—	1	—
UDC SCREW TERMINAL/CABLE ASSEMBLY								
BC40F	Screw terminal/cable assembly for all UDC signal conditioning modules including D/A output. 1 per signal conditioning board.	BW400, BW402 BW403, BA233 BA234, BA235 BA236	60	—	—	—	—	—

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates

AFC11/07 OPTIONS
EXPANDER FILE UNITS

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates
AM07-B	AFC11/07 File Units—provide address decoding, control logic and capacity for mounting up to 32 channels. Requires four-eight-channel multiplexers and signal conditioning modules for full implementation.	AFC11/07	300	—	—	—	3	30
BA150	**Multiplexer Module** Eight-channel flying capacitor Multiplexer Module. Each AM07-B file unit accommodates up to four multiplexer modules (32 channels).	AFC11/07 AM07B	300	—	—	—	4	40 Note 2
	Analog Signal Conditioning Module Eight-channel Signal Conditioning Module (one required per BA150). Provides filtering, scaling or attenuation, and connection to screw terminal/cable assembly.							
BA903	Direct Signal Conditioning (−200 mV to +10.0V).	BA150	40	—	—	—	4	—
BA904	Voltage/Voltage Signal Conditioning (−2.0 to +100.0V).	BA150	150	—	—	—	4	—
BA905	Current/Voltage Signal Conditioning (−20 mA to +50 mA).	BA150	80	—	—	—	4	—

AFC11/07 SCREW TERMINAL/CABLE ASSEMBLY

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates
BC90F	Screw terminal/cable assembly provides screw terminal connectors for 8 pair of input field wiring. One BC90F connects to one eight-channel Signal Conditioning Module.	BA903 BA904 BA905	60	—	—	—	—	—

COMMUNICATIONS
ASYNCHRONOUS INTERFACES

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates
KL11-A	Full Duplex Asynchronous Line Interface Unit; 110 Baud.	11/07	400	G	0	1	6	60
KL11-B	Full Duplex Asynchronous Line Interface Unit; 150 Baud.	11/07	400	G	0	1	6	60
KL11-C	Same as KL11-B, except 300 Baud.	11/07	400	G	0	1	6	60
KL11-D	Same as KL11-B, except 600 Baud.	11/07	400	G	0	1	6	60
KL11-E	Same as KL11-B, except 1200 Baud send, 110 Baud receive.	11/07	400	G	0	1	6	60
KL11-F	Same as KL11-B, except 2400 Baud.	11/07	400	G	0	1	6	60
DC11-AA	Dual Asynchronous Serial Line System Unit and Clock for mounting 2 DC11DA Module Sets. 110, 134.5, 150, 300 Baud (typical speeds with 103 modem, program selectable).	11/07	250	B	1	0		50
DC11-AB	Same as DC11-AA except 110, 300, 1200 and 1800 Baud (typical 202 speeds, program selectable).	11/07	250	B	1	0	3	50
DC11-AC	Same as DC11-AA except 110, 150, 600 and 1200 Baud (typical European, program selectable).	11/07	250	B	1	0	3	50
DC11-AD	Same as DC11-AA except 50, 110, 134.5, 150 Baud.	11/07	350	B	1	0	3	50
DC11-AE	Same as DC11-AA except 75, 110, 134.5, 150 Baud.	11/07	350	B	1	0	3	50
DC11-AG	Same as DC11-AA except 134.5, 150, 300, 1200 Baud.	11/07	250	B	1	0	3	50
DC11-AH	Same as DC11-AA except 110, 134.5, 600, 1200 Baud.	11/07	250	B	1	0	3	50
DC11-AX	Same as DC11-AA except 110, 134.5, 150 Baud plus one non-standard Baud rate above 600 Baud.	11/07	350	B	1	0	3	50
DC11-DA	Full Duplex Serial Module Set for DC11-A (DC11-A accommodates 2 ea.) with EIA/CCITT termination suitable for direct use with 103 or 202 modems. Handles 5, 6, 7 or 8 bit codes with 1 or 2 stop bits.	Any DC11-A	600	—	—	—	7	50
H312A	Asynchronous Null Modem—allows direct connection of any peripheral having an EIA 232 interface. Mounts DC11-DA, DP11-DA or DM11-DB. Note: DP11-KA required with DP11-DA.		60	—	—	—		50
DM11-AA	Asynchronous 16-Line Single Speed Multiplexer and Mounting Panel. Includes space for mounting up to 4 line adapters (16 line interfaces). Order must specify the Baud rate (up to 1200 Baud for 16 lines). If no speed is specified, 110 Baud will be supplied. (115V).	11/07	3,200	B	2	—	30	175
DM11-AC	Same as above; for 230V, 50 Hz.	11/07	3,200	B	2	—	30	175
DM11-DA	Line adapter which implements four Teletype lines (data only).	DM11-AA	150	J	—	—	5	40
DM11-DB	Line adapter which implements four EIA lines (data only). Includes four 25' modem cables.	DM11-AA	450	J	—	—	10	40

SYNCHRONOUS INTERFACES

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Spaces Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates
DP11-DA	Full/Half Duplex Synchronous Line Module Set and System Unit. Double buffered. EIA/CCITT termination suitable for direct use with 201 modems. Includes 25' modem cable. Space available for one DP11-CA or DP11-KA.	11/07	1,400	B	1	—	18	125
DP11-CA	Data/Sync Register Extender. Adds the ability to handle 10-, 11-, and 12-bit data characters. Mounts in DP11.	DP11-DA or DP11-DC	300	—	—	—	3	50

MOUNTING CODES

A—Mounts in Basic Mounting Box
B—Mounts in Basic or Extension Mounting Box
C—One MR11-A mounts in a single System Unit which is included with the purchase of the MR11-A option. Each MR11-A requires one System Unit of mounting space.
D—Mounts in the KA11 Processor
E—Mounts on rear door of H960-CA or similar cabinet
F—Line Printer free-standing HWD (inches)=46 x 24 x 22

G—Mounts in one of the two small peripheral controller slots in the KA-11 or one of the four small peripheral controller slots in a DD11-A.
H—Cabinet Mounted
I — Cabinet Mounted; cabinet included in price of option.
J — Mounts in 5" rack panel (provided with DM11-AA).
K—Mounts in file unit mounting area. (See configuration guide)
L—Mounts in Expander Box. (See configuration guide)
*Interface modules available from module sales.

Note 1

When ordering PDP-11 systems it is important that sufficient mounting hardware is ordered to accommodate each system. Particular attention should be given to the number of DD11's required.

DD11's are System Units prewired to mount small peripheral controllers such as a Teletype control or a High Speed Paper Tape Reader/Punch control. Each DD11 can hold four controllers and mounts in $\frac{1}{6}$ of a Basic or Extension Mounting Box. This is in addition to the two small peripheral controller slots available in the KA-11.

To determine the number of DD11's to order, total the number of spaces required for each item ordered times the quantity ordered. Subtract two from this number and divide by four. Round up to the next whole number if there is a remainder. Order this number of DD11's.

$$\frac{\text{\# of "Spaces" used} -2}{4} = \text{\# of DD11's needed.}\quad \text{Note: Round up to a whole number.}$$

See configuring guide for mounting space available.

Note 2

When shipped as part of a complete AFC or UDC subsystem, installation cost will be only 25 percent of this amount.

CONFIGURING GUIDE
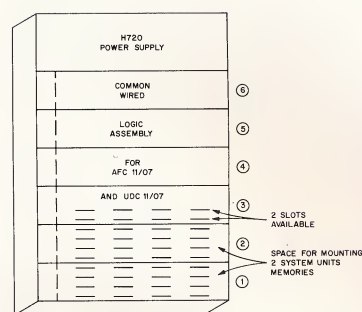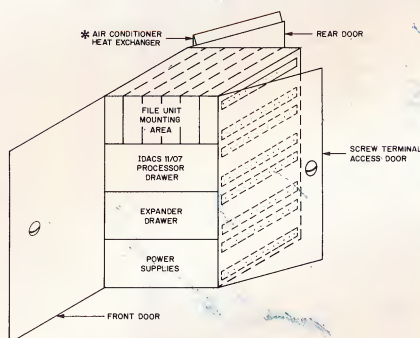
EXPANDER DRAWER
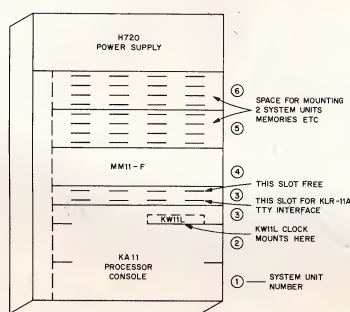
IDACS 11/07 PROCESSOR DRAWER
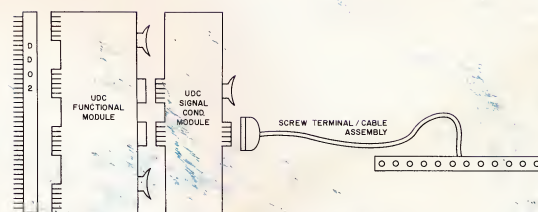
UDC11/07 MODULE ASSEMBLIES
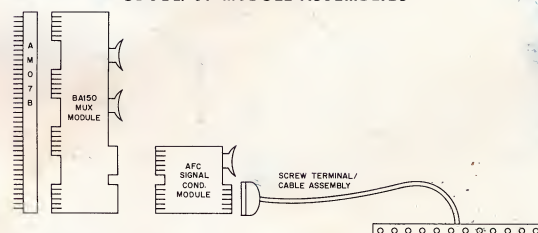
AFC11/07 MODULE ASSEMBLIES

*Use Heat Exchanger for outside ambient temp. up to 105°C.
Use Air Conditioner for outside ambient temp. up to 125°C.

All prices quoted are FOB Maynard, Massachusetts and apply in the continental United Stated only. Federal, state, and local taxes are not included.

All prices and specifications are subject to change without notice. For 11/07 Quantity Discount Policy, Contact Idacs 11 Product Line Mgr.

DIGITAL EQUIPMENT CORPORATION

LAB11

FOR OTHER OPTIONS
AND PERIPHERALS
CONSULT THE PDP-11/20
PRICE LIST

Prices/Configurations/Master Order Form
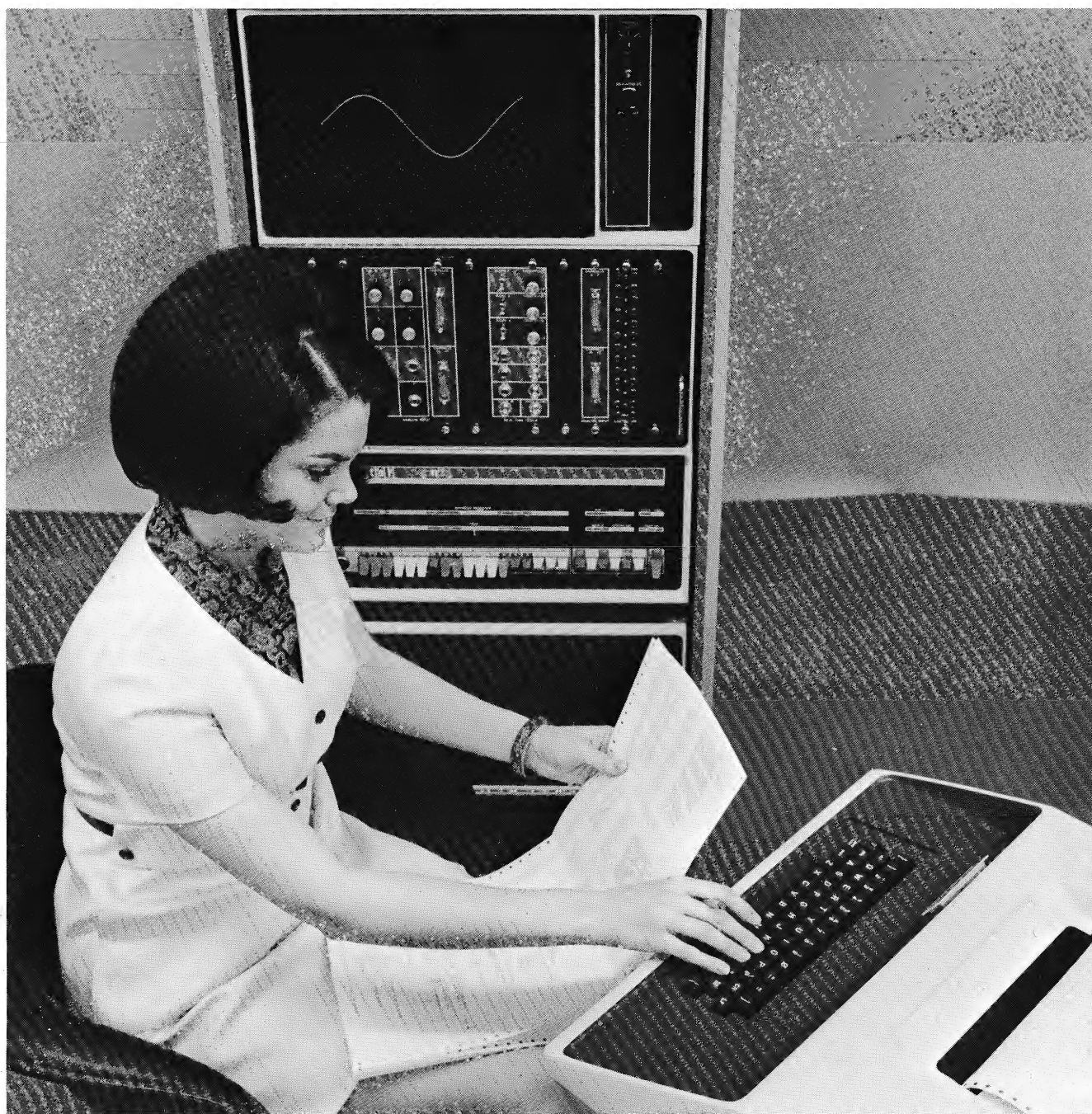
digital

ADVANCED LAB 11-A SYSTEM (SPECIFY VOLTAGE & FREQUENCY)

Consisting of:

PDP-11/20	Computer and KSR-33 Teletype
MM11-F	4K additional memory
PC11	High-speed reader/punch
H945-AB	Lab data panel (contains a speaker)
KW11-P	Real-time clock (programmable) with one Schmitt Trigger
KW11-F	Front panel for clock
AD01-D	A/D converter subsystem
A124	Mux module of 4 channels each (2 required)
AH04	Sample-and-hold
AH05	Sign bit (11th bit)
AD01-FA	Front panel for the first 16 channels of the A/D. Includes parameter knobs and connectors.
VC20	Color display controller
VR20	7" x 9" color display (red and green)
BA11-ES	Extension mounting box
H720	Power supply
DD11-A	Peripheral mounting box
H960-CC	19" free standing cabinet

SYSTEM LIST PRICE $30,795
SYSTEM PACKAGE PRICE $27,500
1 SHIFT MAINTENANCE $ 245

LAB 11 SYSTEM COMPONENTS

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Space Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Quantity	Totals	
										Non-Discounted	Discounted

COMPUTER

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Space Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Quantity	Non-Discounted	Discounted
PDP-11/20-N*	Same as above—rack mounted in H960-CC		11,150	—	—	—	110	N/A			

CORE STORAGE

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Space Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Quantity	Non-Discounted	Discounted
MM11-E	4K Core Memory, 1.2 μsec cycle time	PDP-11/20	3,000	B	1	0	25	150			
MM11-F	4K Core Memory, 950 nsec cycle time	PDP-11/20	3,500	B	1	0	25	150			

PAPER TAPE

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Space Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Quantity	Non-Discounted	Discounted
PC11	High-speed reader/punch	PDP-11/20	3,900	G	0	1	30	320			

REAL-TIME CLOCK

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Space Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Quantity	Non-Discounted	Discounted
KW11-P	Programmable, real-time clock, crystal controlled, 4 counting rates, one Schmitt Trigger which fires at TTL levels.	PDP-11/20	600	—	—	—	3	50			
KW11-F	Front Panel for Real-Time Clock	KW11-P H945-AB	50	—	—	—	2	15			

ANALOG-TO-DIGITAL CONVERTER

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Space Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Quantity	Non-Discounted	Discounted
AD01-D	A/D Conversion Subsystem expandable to 32 channels, 10 bits + sign, single ended, program selectable input ranges of: 0 to +1.25V, +2.5V, +5.0 or +10.0V unipolar; 0 to ±1.25V, ±2.5, ±5.0V, ±10.0V bipolar.	PDP-11/20, H960-CC	2,400	H	0	—	20	150			
AH05	Sign Bit, 11th Bit, 2's complement	AD01-D	400	—	—	—	6	80			
A124	MUX module 4 channels	AD01-D	60	—	—	—	2	8			
AH04	Sample-and-hold	AD01-D	300	—	—	—	3	60			
AD01-FA	A/D front panel which contains parameter knobs and connectors for the first 16 A/D channels (channels 0–15)	AD01-D, H945	250	—	—	—	3	50			
AD01-FB	A/D front panel which contains connectors for the second 16 A/D channels (channels 16–31)	AD01-FA	150	—	—	—	1	15			

*A=115V, 60 Hz; B=230V, 50 Hz; C=230V, 60 Hz; D=100V, 50 Hz

Type Number		Prerequisites	Price	Mounting Code	System Units Module Mounting	Space Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Quantity	Totals Non-Discounted	Totals Discounted

CRT DISPLAY

Type Number	Description	Prerequisites	Price	Mounting Code	System Units Module Mounting	Space Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Quantity	Non-Discounted	Discounted
VC20	10-Bit Color Point Plot Display Controller	PDP-11/20	2,750	—	—	—	14	100			
VR20	7" x 9" Color (Green & Red) Point Plot Computer Display	PDP-11/20 VC20	4,000	—	—	—	22	100			
AA11-FA	Front Panel with connector that brings out the D/A signals for an extension scope. Also includes a speaker control knob.	VC20 H945-AB	150	—	—	—	2	15			

MISCELLANEOUS HARDWARE

Type Number	Description	Prerequisites	Price	Mounting Code	System Units Module Mounting	Space Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Quantity	Non-Discounted	Discounted
H945-AB	Rack mountable NIM-dimensionally compatible Lab data panel. It accommodates parameter knobs & connectors for A/D's, real-time clock and Schmitt Trigger, and Digital I/O connectors when these options are implemented.	PDP-11/20 H960-CC	200	—	—	—	N/C	50			
DR11-A	General-purpose digital interface to the PDP-11, permits bidirectional transfer of 16 bits in parallel from the user's device to the PDP-11 UNIBUS.™ Contains all necessary interrupt, address, and control signals to allow the user to interface the PDP-11 directly. Includes cable connectors.	PDP-11/20	400	G	0	1	5				
DR11-F	front panel with connector for the Digital I/O option	DR11-A H945-AB	100	—	—	—	1	15			
DD11-A	Peripheral mounting panel (includes UNIBUS connector module M920). Prewired system unit for 4 small peripheral controllers (one system unit).	PDP-11/20	175	B	1	—	—	50			
BA11-ES	Extension mounting box with tilt and lock chassis slides. Includes fans and BC11A-8F UNIBUS cable.	None	400	—	—	—	—	60			
H720	Power supply 115V 50/60 Hz.	None	600	B	—	—	—	—			
H960-CC	Free standing base cabinet. Includes fans, power distribution panel, extension feet, front bezel panels.	None	650	—	—	—	—	—			

SOFTWARE PRICES

Type Number	Description	Prerequisites	Price	Mounting Code	System Units Module Mounting	Space Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Quantity	Non-Discounted	Discounted
QJL01-A	Signal Averager		500	—	—	—					
QJL02-A	BASIC		500	—	—	—					

MISCELLANEOUS ITEMS

SPECIAL SYSTEMS (Quote No.   , date   )

**IMPORTANT
COMPLETE AND ATTACH
DOMESTIC ORDER SHEET.**

SUB-TOTAL, DISCOUNTABLE ITEMS

LESS   % DISCOUNT

TOTAL, DISCOUNTABLE ITEMS

SUB-TOTAL, NON-DISCOUNTABLE ITEMS

SYSTEM TOTAL

INSTALLATION CHARGES ON FIELD-INSTALLED OPTIONS

LAB-11 LITERATURE REQUEST

Thank you for your interest in DIGITAL.

Please send me more detailed information on the new LAB-11 systems

My application is:

☐ Education   ☐ Industrial   ☐ Biomedical   ☐ Chemical   ☐ Other_____

☐ I am planning to purchase a computer within six months.

☐ Please have a DIGITAL salesman call me._____
                                             Area Code   Telephone #

☐ I am updating my reference file.

Please send this literature to:

Name_____ Title _____

Organization_____ Dept. _____

Street _____

City_____ State_____ Zip _____

NOTE: Please check here if your organization does not accept THIRD CLASS MAIL. ☐

MOUNTING CODES

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B—Mounts in Basic or Extension Mounting Box

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D—Mounts in the KA11 Processor

E—Mounts on rear door of H960-CA or similar cabinet

F—Line Printer free-standing HWD (inches) = 46 x 24 x 22

G—Mounts in one of the two small peripheral controller slots in the KA11
    or one of the four small peripheral controller slots in a DD11-A.

H—Cabinet Mounted

TYPICAL CABINET CONFIGURATION

—— LAB11 ——
PC11 High Speed Reader/Punch
VR20 Two Color Display
H945 Lab Data Panel
PDP-11/20 CPU
BA11-ES Extension Mtg. Box
AD01-D A/D Converter

digital

DIGITAL'S CREDENTIALS

The DIGITAL story is singular in the computer industry. Founding the minicomputer market in 1963, DIGITAL now has over 20,000 computer installations throughout the world, over 100 sales factories in five countries.

The product breadth of the company is also unequaled. Small, medium, or large-scale computer systems vary in price from under $4000 to several million dollars. A full line of peripheral equipment is also available. Most of the line is DIGITAL-designed and built and is therefore processor compatible and manufactured and tested to rigid specifications.

DIGITAL is also the world's leading manufacturer of circuit modules, providing industrial control modules, analog and digital conversion equipment, and high-speed computer modules.

In addition to standard products, DIGITAL provides design services—products can be designed and fabricated to customer specifications....And the company is still growing at a rapid rate, averaging over 12 new products per month.

PRODUCT SERVICING

DIGITAL's success is due in large measure to the company's field service organization with its more than 1000 engineers in 100 world-wide service centers.

It is this service organization that tests each system prior to shipment, installs the system, and through a large variety of contract types, assures its continued operation.

Services range from standard 8-hour shifts to full 24-hour coverage in contracts that include preventive maintenance as well as repairs. In resident service, an engineer is located full-time at the customer's site. And for less demanding requirements, service is available on a charge-per-call basis.

In addition to equipment servicing, DIGITAL provides software specialists to handle customer on-site training, application program assistance, and service calls, so that software problems receive fast, efficient service.

TRAINING

Formalized software and hardware training is available to every DIGITAL customer. Full time training staffs conduct regularly scheduled courses at training centers in Maynard, Massachusetts; Sunnyvale, California; Paris, France; Munich, Germany; and Reading, England. Schedules are available through any DIGITAL office.

By special arrangement, courses can be designed to meet specific requirements and may be given at the customer's site.

OTHER SERVICES

For special design requirements, DIGITAL provides the following. A Computer Special Systems Group designs non-standard system equipment to customer specifications. A Systems Engineering Group specializes in the development of multi-processor networks. And a Control Products Group develops unique control interfaces and devices employing DIGITAL-designed and fabricated logic modules.

DECUS, the Digital Equipment Computer Users Society —the most active users group in the world—is designed to stimulate the exchange of information and help solve common problems. Representing some 10,000 users from more than 40 countries, the society sponsors an active newsletter and operates periodic local and national symposia. The society also maintains an invaluable library of user-contributed programs which is available to all members.

CUSTOMER APPLICATION GROUPS

The following DIGITAL groups service specialized areas of customer interest. An Industrial Products Group handles industrial control and data acquisition applications. The Laboratory Data Products Group is responsible for laboratory systems in the physical and life sciences. A Medical Systems Group specializes in products for hospitals and diagnostic clinics. A Graphics Arts Group supplies computerized typesetting systems and other graphic products to the newspaper and publishing community. An Education Group specializes in systems for secondary schools, junior colleges, and universities. A Data Systems Group handles commercial data processing systems. A Communications Group supplies products that meet a wide variety of data communications problems.

Separate groups also handle the needs of Original Equipment Manufacturers (OEM's).

PDP-11/40...
THE BALANCE
BETWEEN
COST AND
POWER

Between the small, dedicated computer and the larger computing installation lies a class of users that require power and expansion capability, yet must be vitally aware of costs. It is this class of users to which the PDP-11/40 appeals.

The PDP-11/40 is designed to keep price down without sacrificing speed. The combination of PDP-11 architecture and basic instruction speed provides excellent power for almost any small or medium scale computing requirement. Low price is maintained by implementing the design with conventional logic and by using efficient microprogramming techniques.

The system also provides almost unlimited expansion capability without making the user buy more than he needs. Core memory starts at 8 K and can be expanded to 128 K through the system's memory management option. A wide variety of mass storage is available, including several types of magnetic tape and three disk storage systems. Through a unique UNIBUS™ design, system components are easy to add—peripherals, memories, and processors merely plug into the single asynchronous bus.

PDP-11 systems are always upwards compatible; for example, a PDP-11/20 processor can easily be substituted for a smaller family processor.

In addition to meeting these basic needs, PDP-11/40 provides features that make programming simple…features that are standard to the PDP-11 family yet are rarely found in other small or medium scale computers.

The system's instruction set provides byte addressing to simplify communications applications. Eight general registers provide wide flexibility, since they are not preassigned or restricted as to usage. Hardware stacks are an invaluable tool for the implementation of reentrant or recursive software and for many other tasks.

The user can also select a hardware floating point option, a unique design that achieves exceptional speed and accuracy at very low cost.

The PDP-11/40 has power and the broad expansion capability that a user needs to start small, and grow…power available at prices well within reasonable budget limits.

™ Registered trademark of Digital Equipment Corporation

UNIBUS ARCHITECTURE

A key to the PDP-11 family's many strengths is the fact that all system elements—processor, memory, peripherals—plug into a single asynchronous high speed bus. Known as a UNIBUS, this bidirectional bus provides easy interfacing and simplifies the construction of multiprocessor or shared peripheral configurations.

UNIBUS architecture keeps PDP-11 systems from becoming obsolete. Due to its asynchronous nature, the UNIBUS is compatible with devices that operate over a wide range of speeds. Therefore, faster devices or memory can always replace older versions without obsoleting the system.

With the UNIBUS, fast devices have easy direct memory access—no multiplexers or synchronizing DMA hardware is required. These devices can send, receive, or exchange data without processor intervention and without intermediate buffering in memory. Transfers on the bus take place at rates up to 2.5 million words per second.

UNIBUS ™

| PDP-11 PROCESSOR | MEMORY | SWAPPING DISK | DISK PACK | LINE PRINTER | CARD READER | TERMINAL |
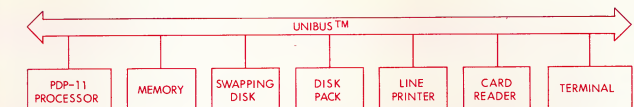
…FOR EASY INDUSTRIAL INTERFACING

Easy interfacing is a basic requirement of an industrial computer system, letting the user add special equipment with a minimum of effort. With the PDP-11, interfacing is simple and the UNIBUS handles a wide variety of devices, regardless of speed, with plug-in ease.

CORE MEMORY

Expanding the PDP-11/40 is as easy as plugging in modules. Read/write core memory is available in 8 K word modules of 900 nanosecond speed which can be interleaved to achieve faster memory cycle times. Maximum system memory of up to 128 K words can be comprised of DIGITAL-manufactured memory of different speeds and characteristics so that the new memory can always be added to, or replace, the old.

Bootstrap loaders—32 words of read only memory—are available for automatic loading of disk, DECtape, and paper tape. These options eliminate manual key-in of startup data and are extremely useful when the system is being operated by non-computer oriented personnel.

A special uncoded loader lets the user prepare a bootstrap for a special device; he merely clips unneeded diodes from the circuitry.

MEMORY MANAGEMENT AND USER PROTECTION

The PDP-11/40's memory management facility allows a 16-bit machine to provide 18-bit capability for a sizeable extension of addressable memory. Through this facility, system memory can be expanded from its basic 28 K words to a maximum of 128 K words, more than 4 times its normal capability.

The user has access to this memory in up to 32 K units through 8 programmable registers. These registers assign (or map) the user's virtual addresses, in 4 K pages, to 4 K physical addresses anywhere within core memory. The starting address of each 4 K physical segment is stored in the registers.

The user need only provide virtual addresses; transformation to physical addresses takes place automatically and transparently in less than 200 nanoseconds.

For flexibility, there are two sets of these registers—one for user programs and another for the executive. The executive can be assigned to separate 4 K pages or, for convenience, both can be assigned to some of the same shareable pages.

Another function of memory management is to provide user and monitor protection in a multi-user environment. This function is implemented through two additional sets of registers associated with the physical address registers—one for the user and the other for the executive. These programmable registers contain the length of each page that is less than 4 K. If a program tries to access outside of its page boundaries, it is automatically switched into executive mode before it can do any damage.

The length registers also contain protection codes, letting the programmer restrict the segment to "no access" or "read only." The register also recognizes a special flag that denotes whether the segment of code has been modified. This flag is extremely useful, particularly when code is being swapped from disk to core. As long as the flag is not set, the monitor does not have to save the copy, since it already exists on disk.

PHYSICAL MEMORY
0 - 128K

READ ONLY
READ / WRITE
READ / WRITE

VIRTUAL
ADDRESS
RANGE

PHYSICAL
STARTING
ADDRESSES

| 28-32K |
| 24-28K |
| 20-24K |
| 16-20K |
| 12-16K |
| 8-12K |
| 4-8K |
| 0-4K |

32K VIRTUAL
ADDRESSES

READ ONLY
READ / WRITE
READ / WRITE

SHARED EXECUTIVE/USER
SHARED EXECUTIVE/USER
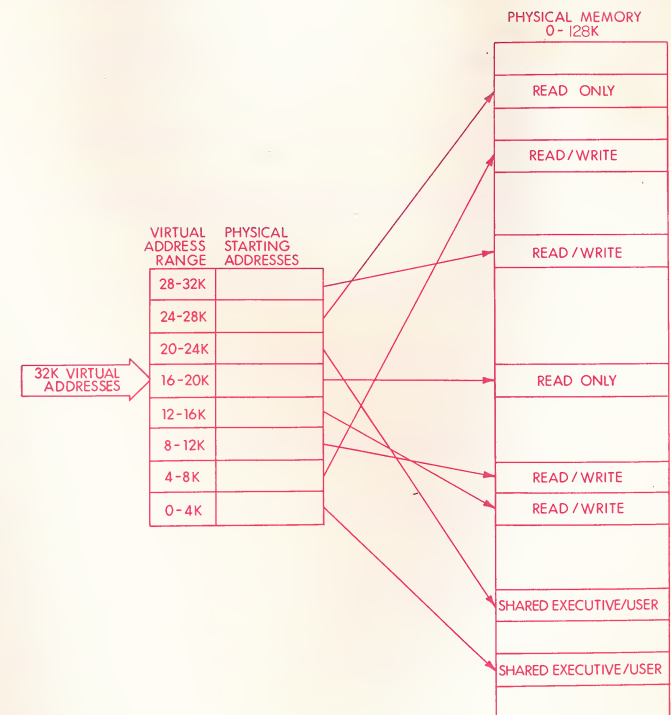
...FOR EASY SYSTEM EXPANSION

With the PDP-11/40, expansion is never limited. The user can always add core, storage and peripherals, quickly and easily. Due to the asynchronous nature of the UNIBUS, new devices and new, faster memory will always be compatible and can always be added to existing memory.

...FOR BUSINESS SORTING PROBLEMS

The sorting of large volumes of information is a very common requirement of a business computer system—one which can require extensive core memory. With the PDP-11/40's memory management facility, up to 256 K bytes are available to meet the most demanding of applications.

HARDWARE FLOATING POINT

The PDP-11/40 sets a new computation standard by providing fast arithmetic operations at low cost. In addition to traditional integer arithmetic, the system offers an exceptional hardware floating point option which employs micro-programming techniques (firmware) to keep price down and, at the same time, achieve fast execution times.

The 11/40 floating point unit uses a unique format to provide additional accuracy. In the traditional format, the left hand bit of the normalized fraction (bit 8 of 32) is always set. The PDP-11/40 takes advantage of this fact by shifting one bit to the left during normalization. The result is an increase in accuracy of at least one bit over the usual binary method and four bits over hexadecimal techniques.

Floating operations take place on the top of a hardware stack in Polish accumulator technique. Therefore operations are performed in sequence, intermediate results being stored automatically by the stack, then used in the next sequential operation until calculation is complete. Without the stack, each equation term would have to be calculated separately, stored, then called for use in sequential steps.

SIGN	EXPONENT		FRACTION

HIDDEN BIT

0 — 8 — 32
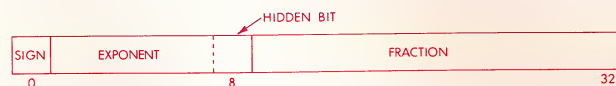
...FOR FAST, ACCURATE CALCULATIONS

A fast floating point processor is essential, if calculation speed and accuracy is to be achieved. The PDP-11/40 floating point processor—through its unique design features—not only provides these requisites, but it provides them at the lowest price ever.

INSTRUCTION SET

The PDP-11's comprehensive instruction set provides the programming flexibility of a large computer in a 16-bit mainframe. The set provides unusual but often required instructions, so that a single instruction often suffices where several may be required in a traditional machine. For example, a bit test instruction (BIT) can test any bit or combination of bits to determine their state. In a conventional machine, this task would require several masking operations.

Bit, byte, and word addressing in both single and double operand formats make possible memory saving and simplify the implementation of control and communications applications.

PDP-11 double operand instructions allow a programmer to perform several operations with a single instruction. For example, ADD A, B adds the contents of location A to location B and stores the result in location B. With the traditional instruction set, three instructions would be required (see example).

Due to the system's UNIBUS, the PDP-11 does not require special I/O instructions; the same instruction that performs a register-to-register transfer performs a memory-to-device register transfer or a memory-to-memory transfer. Therefore, in the double operand instruction ADD A, B, A and B can be registers, a register and a memory location or two memory locations.

The instruction set contains a full set of conditional branches, eliminating excessive use of "jump" instructions. A branch is also included for overflow of a signed integer. Many computers over-economize and eliminate this branch therefore requiring a 5 to 8 instruction subroutine to perform this important function.

All instructions can directly address the full 32 K word memory and I/O space.

PDP-11
ADD A, B Add contents of location A to location B and store results in location B.

Conventional
LDA A Load contents of location A into accumulator.
ADD B Add contents of location B into accumulator.
STA B   Store results in location B.

...FOR COMMUNICATIONS CHARACTER HANDLING

Byte instructions make the PDP-11/40 an ideal processor for communication problems, since each 16-bit word can hold two 8-bit characters. The system serves easily as a front end data preprocessor for a larger system or as a satellite computer in a hierarchical system.

8 GENERAL REGISTERS

With 8 general registers, the PDP-11 gives the programmer the flexibility and speed of a large-scale computer.

Most small computers have 2 to 4 registers which are generally used as accumulators and sometimes used as index registers. Since PDP-11 registers are not dedicated to specific functions, the programmer can assign them dynamically, depending on whether he needs to manipulate a pointer, achieve speed, or use the registers for temporary storage.

Where speed is the criterion, register-to-register operations can be performed. The PDP-11 also allows direct memory-to-register operations. For example, the programmer can add from memory to a register without first having to load one register then add into another register, as with conventional systems.

Registers can also be reserved for time critical partial results or pointer functions. The system can perform memory-to-memory operations, leaving the registers free.

Through the PDP-11's auto-increment and auto-decrement modes, pointer manipulation is easy, simplifying the handling of such structured data as arrays and character strings. To step through a table in the forward direction, the pointer is auto-incremented; when the decrement mode is used, the same pointer can be backed up.

Register architecture makes it easy to implement other advanced computer concepts without writing long software routines. These concepts include: reentrant or shareable subroutines (see section on Stacks), recursive routines, and position independent code.

The registers plus the flexible addressing modes of the system allow the PDP-11 to handle these and other difficult computing situations with exceptional ease.

...FOR SIMPLIFIED GRAPHICS SOLUTIONS

Graphics applications require fast calculations to achieve such real-time functions as zoom, rotation, clipping. The multiple registers of the PDP-11/40 are an excellent tool for solving graphics problems. For example, they can act as pointers, allowing the program to step through tables of display characters.

HARDWARE STACKS

For convenient handling of frequently used data, PDP-11 computers employ a hardware pushdown stack, a powerful built-in data storage feature normally found only on larger computers.

Stacks speed the servicing of interrupts and subroutine calls by providing fast temporary storage of program information. For example, when an interrupt occurs, the status of the interrupted routine is stored or "nested" on the stack. As soon as the higher priority task has been completed, the status information is "popped off" the stack and the interrupted routine is resumed automatically.

Without the stack, much core and time would be wasted, since a separate subroutine would be required to store the status information on each interrupted task.

With stacks, users can also share common (reentrant) code, saving much valuable core space. Instead of each user requiring his own copy of a particular routine, several users can share the same routine copy.

A user program, for example, can start executing the common code and be interrupted by another program which also requires the code. The stack stores information on the breakpoints so that each user program can reenter the code at the proper point and finish execution.

PROGRAM A
SHARED SUBROUTINE X
PROGRAM B
PROGRAM C
PDP-11

PROGRAM A
SUBROUTINE X
PROGRAM B
SUBROUTINE X
PROGRAM C
SUBROUTINE X
CONVENTIONAL

...FOR TEACHING ADVANCED CONCEPTS

PDP-11's are ideal learning tools, providing the student with the sophisticated features that most small computers leave out. With the hardware stacks of the PDP-11/40, for example, the student can learn such advanced computer concepts as reentrant and recursive subroutining, and Polish accumulator operations.

HARDWARE INTERRUPTS

The interrupt system for the PDP-11 is another new departure in small computer technology. With fully vectored interrupts, the system eliminates the high overhead software that determines which device service routine to use and the code necessary to save system status. In addition, the multi-level hardware interrupt system is a standard PDP-11 feature not an extra-cost option.

The PDP-11 system consists of four priority levels, each of which can handle an almost unlimited number of devices. The priority of the device is a function of the device's physical position—the closer to the processor, the higher its priority on that level.

The priority system makes an excellent use of the PDP-11's hardware stacks. When the processor services an interrupt, it first saves important program information on the stack. This information enables the processor to return automatically to the same point in the program and the same conditions, once the current interrupt or interrupts have been serviced.

In the PDP-11, the device causing the interrupts provides a direct vector to its own service routine, eliminating the slow and tedious operation of polling all devices to see which one interrupted.

The device also provides status information for its own service routine. Thus the programmer has the flexibility of assigning a device to a higher priority and its service routine to a lower priority without writing special software.

The system also allows interrupts to be enabled or disabled, through software, during program operation. Such masking allows priorities to change dynamically in response to system conditions. For example, a real-time program could disable data entry terminals whenever critical analog data is being collected. As soon as the scan was complete, the terminals would be automatically enabled and be ready to input data.

With the PDP-11, any number of interrupts can be enabled or disabled; other systems are restricted to 16 by virtue of their word length.

FOR IMMEDIATE RESPONSE TO CRITICAL DATA

To control a laboratory or industrial process, a computer must provide immediate response to critical real-time variables, otherwise valuable data may be lost. With the PDP-11/40's flexible structure, device priorities are easy to assign and direct vectors assure fast response so that data is easy to gather and process.

POWER FAIL PROTECTION AND AUTOMATIC RESTART

Power fail protection and automatic restart are standard PDP-11 features which protect user programs and minimize downtime in the event of power outages or fluctuations.

When the system senses a failure or severe power fluctuation, it has a sufficient amount of stored power from the power supply to protect the program in memory and shut down the system in orderly fashion. A user-developed shutdown program protects system and special devices from harm and saves important registers.

When the power returns to safe operating levels, the system is automatically restarted via a user pro-grammed routine. Unattended systems can thus resume operation without human intervention.

...TO SAVE ON-LINE MEDICAL DATA

With most small computer systems, a power failure handling system costs extra and is limited in function as well. With the PDP-11/40, power fail/restart is a standard feature which guarantees data protection—an extremely important factor for on-line medical applications.

INSTRUCTION SET

SINGLE OPERAND

			μsec^1
CLR	(B)	Clear	0.990
COM	(B)	Complement	0.990
NEG	(B)	Negate	0.990
INC	(B)	Increment	0.990
DEC	(B)	Decrement	0.990
ADC	(B)	Add Carry	0.990
SBC	(B)	Subtract Carry	0.990
TST	(B)	Test	0.990
ROR	(B)	Rotate Right	1.25
ROL	(B)	Rotate Left	0.990
ASR	(B)	Arithmetic Shift Right	1.25
ASL	(B)	Arithmetic Shift Left	0.990
SWAB		Swap Byte	0.990
SXT		Sign Extend	0.990
MFPI	Mode	Move from Previous Space	3.50
MTPI	Communication	Move to Previous Space	3.68

BRANCH

BR	Unconditional Branch	
BEQ	Equal (Zero)	
BNE	Not Equal	
BMI	Minus	
BPL	Plus	
BCS/C	Carry Set/Clear	branch 1760
BVS/C	Overflow Set/Clear	no branch 1260
BLT	Less Than	
BGE (Signed	Greater Than or Equal	
BLE Integer	Less Than or Equal	
BGT	Greater Than	
BHI	Higher Than	
BLOS Unsigned	Lower or Same	
BHIS Integer	Higher or Same	
BLO	Lower Than	
SOB Loop Instruction	Subtract 1, Branch if Non-Zero	branch 2360 no branch 2040

DOUBLE OPERAND

			μsec^1
MOV	(B)	Move	0.900
ADD		Add	0.990
SUB		Subtract	0.990
CMP	(B)	Compare	0.990
BIT	(B)	Bit Test	0.990
BIC	(B) Boolean	Bit Clear	0.990
BIS	(B)	Bit Set	0.990
MUL		Multiply	9.26*
DIV		Divide	11.61
XOR		Exclusive OR	0.990*
ASH		Arithmetic Shift	6.00*
ASHC		Arithmetic Shift Combined	8.96*

CONTROL

JMP	Jump	1.80
JSR	Subroutine Jump	2.99
RTS	Return From Subroutine	2.42
MARK	Reentrant Restore	2.50
RTI, RTT	Return From Interrupt	2.92

CONDITION CODE

SET C, V, N, Z	Set Selected Bit(s)	1.72
CLR C, V, N, Z	Clear Selected Bit(s)	2.02

MISCELLANEOUS

HALT	Stop	1.12
WAIT	Wait for Interrupt	1.12
RESET	Initialize	80.0 ms

TRAP

IOT	I/O Call	5.80
EMT	Emulator Call	5.80
TRAP	User Call	5.80
BPT	Breakpoint	5.80

FLOATING POINT

FADD	20.7*
FSUB	21.0*
FMUL	35.9*
FDIV	49.6*

(B) Byte Instruction

[1] Minimum execution time, except as noted.

* Average execution time

PDP-11 SOFTWARE

PDP-11 software ranges from broad-based monitors to specialized applications packages.

The PDP-11's Disk Operating System provides FORTRAN IV that meets ANSI standards. The Resource Time Sharing executive provides a powerful version of BASIC, BASIC-PLUS, that services up to 16 interactive users. And the system's paper tape software includes development and utility programs and provides both single and eight-user BASIC systems.

An industrial control monitor and a communications monitor are available via DIGITAL's Industrial Products and Communications Groups, respectively.

RESOURCE TIME SHARING SYSTEM (RSTS-11)

RSTS-11 is a powerful time sharing executive which allows the PDP-11 to handle up to 16 simultaneous interactive users. With its low cost per terminal, the system is ideal in educational applications such as student research projects and computer assisted instruction systems. In research, it allows scientists and engineers to analyze experimental data and make design calculations on-line. For improved office efficiency, the system can be used for accounting at the same time several users are writing programs for machine calculations.

The RSTS-11 hardware system may be used in a non-time sharing mode with the PDP-11 Disk Operating System.

RSTS uses the powerful BASIC-PLUS programming language. BASIC-PLUS is compatible with existing BASIC programs yet it includes many extended language features such as matrices, strings, files, and special-purpose language additions.

COMTEX-11 is employed in message switching, remote batch systems, line concentrators, front ends, etc. Modular and easily adapted to special requirements, COMTEX-11 is the basis for the DECcomm system software packages.

RSX-11, the PDP-11 industrial control software package, is designed to coordinate the execution of tasks in a multi-programming environment. It provides scheduling, input/output, operator communication, and other related functions.

Each user may have up to 8 K words, or 16 K bytes, of core storage for his program and data. If more is needed, programs may be chained from high-speed disk.

Each user may access a variety of high-speed input and output devices for data files and programs. There are no I/O bottlenecks. Users may create, access and close up to 12 data files simultaneously and store and retrieve their programs from a disk library. Disk files may be accessed in either sequential or random modes.

File security is maintained through a password system. Each user is issued a password so that he can create and store files which can be protected against unauthorized access.

Peripherals are assignable to users, as they require them, for maximum system utilization. RSTS-11 provides support for a wide variety of terminals operating at a diversity of speeds.

PDP-11 DISK OPERATING SYSTEM (DOS) WITH BATCH PROCESSING

The PDP-11 Disk Operating System is a core and disk resident software system which provides the user with the programs he needs for efficient program development and on-line or batch mode execution. To control the DOS monitor and its subsystems, the user issues simple commands via the system's console teleprinter.

For program development, DOS provides a relocatable assembler (MACRO-11), a FORTRAN IV compiler that meets full ANSI standards, on-line editing and debugging programs, and a file utilities package (PIP). For simplified program execution, DOS provides common I/O device handling routines, a linking loader (LINK-11), and operator interface software.

BATCH allows the system to provide job stream processing with a minimum of operator intervention and no programmer interaction. Processing is virtually automatic through control cards submitted with each job.

MACRO-11 is a powerful assembler that provides the user with full macro capability, complete or partial listing of the symbolic program, and lists of symbols with cross reference. Code generated by MACRO-11 is relocatable. Therefore programs can be assembled in separate, easy-to-handle modules and then linked for loading.

LINK-11 combines the separately assembled modules and/or FORTRAN compilations into a single load module. The loader also allows the user to overlay modules stored on disk on top of program segments in core. Overlaying makes it possible to execute programs in segments so that a total program can be larger than the available core memory.

The user can also perform trade-offs to optimize for either processing speed or available core space. By making most modules core resident, he can improve processing speed. Conversely, if he keeps most modules on disk and swaps only when they are required, he can have more space available for other requirements.

The system provides for both sequential and random access file handling. The size of sequential files on disk or DECtape need not be specified in advance; they may grow or shrink dynamically as they are processed. Random access processing uses a powerful directory to permit efficient file access.

The PDP-11 file protection system allows a user to choose from a variety of file protection levels. For example, he can restrict a certain group of users to read-only access of a particular file or protect a file against his own inadvertent deletion. Protection is accomplished through a software identification code.

With DOS software, I/O devices are buffered, so that I/O operations may be overlapped with processing for maximum hardware utilization. Programs are device independent; that is, the user has until run time to specify a device and can respecify the device at any time.

FORTRAN IV

FORTRAN IV operates under PDP-11 DOS, using DOS monitor I/O calls and all DOS peripherals.

PDP-11 FORTRAN provides many language extensions: random access I/O, mixed mode arithmetic, generalized expressions used as array subscripts. An IMPLICIT statement allows the user to control variable type.

Error diagnostics are improved through an error trace-back feature that specifies when the error occurred and all the linkages back to the main program. PDP-11 FORTRAN also allows the user to define how many times errors (e.g., arithmetic overflow) can occur before they become fatal.

Arithmetic can be performed with or without the PDP-11 floating point hardware; PDP-11 FORTRAN will provide up to 24-bit accuracy for two-word (real) formats or up to 56-bit accuracy for four word (double precision) formats.

PAPER TAPE SOFTWARE

Paper tape software for the PDP-11 lets the user develop programs in PAL-11 assembly language or in single-user or 8-user BASIC.

The executive consists of device driver packages and the input/output routines for such devices as the teletypewriter, line printer, and high speed reader/punch.

Paper tape software also includes an on-line editor (ED-11), absolute and linking loaders, an on-line debugging program (ODT-11), and a floating point and math package (FPP-11). The latter package provides the user with common mathematical subroutines which are reentrant or shareable for maximum utilization.

Single-User BASIC

BASIC is the popular problem-solving interactive language that was developed at Dartmouth College and is widely used for scientific and other applications. The language is simple enough to be learned easily by a beginner, yet provides features which give the sophisticated programmer wide flexibility.

With single-user BASIC, the PDP-11 can be used as a calculator, since commands can be executed immediately or stored for later execution. Also, BASIC programs written on other systems can run on the PDP-11 with very few or no modifications.

Single-user BASIC allows machine language subroutines to be part of any BASIC program—a feature which is extremely valuable in data acquisition applications. For example, a major part of a particular program can be written in BASIC language and input/output routines can be written in machine language. Another feature important in program development is error reporting; errors detected by the system are automatically output on the teletypewriter or terminal as development proceeds.

8-User BASIC

Eight-user BASIC is an extension of single-user BASIC which allows up to 8 users simultaneous access to the PDP-11.

In addition to the advantages of single-user BASIC, eight-user BASIC provides:
- Buffered interrupt-driven I/O
- "Open" and "Close" commands which allow BASIC users to select a particular peripheral device such as the high speed paper tape reader/punch or line printer
- Modified "Input" and "Print" commands to let the user program communicate with the device.
- Additional print functions, including character, space, and tab
- Improved diagnostics

PERIPHERALS

ALPHANUMERIC KEYBOARD DISPLAY (VT05)
Low cost, high performance, alphanumeric keyboard display. Provides seven selectable speeds from 110 to 2400 baud. Meets EIA RS232C standards and 20 mA current loop requirements. 64 or 128 ASCII character sets.

DECWRITER DATA TERMINAL (LA30)
Fast, low cost DIGITAL-designed terminal. Prints asynchronously at 30 characters per second. 64 character print set; 96 or 128 character keyboard. Quieter than an electric typewriter. Simple mechanical design for high reliability.

TELETYPES (LT33)
ASR 33 Teletype. Reads, prints, and punches at 10 characters per second. Other models available.

PAPER TAPE READER/PUNCH (PC11)
Reader operates at 300 characters per second. Punch operates at 50 characters per second.

CARD READERS (CR11, CM11, CD11)
Reads up to 1000 cards per minute. Available in mark-sense, punched card and DMA punched card versions.

HIGH SPEED LINE PRINTER (LP11)
Produces up to 1200 lines per minute. 80 or 132 columns. 64 or 96 character print sets.

DECTAPE (TU56)
DIGITAL's economical and unique variety of magnetic tape. Easy to use, transport and store. Convenient 3.9 inch diameter reels hold up to 131,072 16-bit words each and may be updated in blocks. Dual drive system. Insensitive to line voltage or frequency variations. High reliability due to simple design. Ideal for production environment.

DEC MAGNETIC TAPE (TU10)
Industry compatible magnetic tape, 7 or 9 track. Transfers up to 36,000 characters per second. High density— 180 million bits on 9-track and 135 million bits on 7-track. Up to 8 TU10 transports per TM11 controller. DIGITAL-designed unit provides character-by-character parity checks, automatic longitudinal redundancy check, and automatic cycle redundancy check for 9-track unit.

DECPACK CARTRIDGE DISK SYSTEM (RK05)
Economical, large volume removable disk storage. 1.2 million words per drive; 11.08 μsec/word transfer rate. 70 msec average access time. 8 independent drivers per controller for a total system capacity of 9.6 million words.

DECDISK SYSTEM (RS64)
Fast, low cost DIGITAL-designed fixed head disk system. A single DECdisk and control provides 64 K words of storage. RC11 controller will operate up to 4 disks for a total of 262,144 words of storage. Full cycle redundancy data checking. Rugged packaging for industrial applications.

DISK AND CONTROL (RF11 'RS11)
Fast, fixed head disk system. 16 μsec per word transfer rate. 17 msec average access time. RS11 drive capacity is 256 K words. RF11 controller can operate up to 8 drives for a total capacity of over 2 million words.

STORAGE DISPLAY (VT01)
Tektronix Type 611 direct view storage scope. Resolution: 300 stored line pairs vertically and 300 line pairs horizontally. Displays 4000 flicker free characters or 30,000 discrete resolvable points.

POINT PLOT DISPLAY (VR14)
Compact CRT display with 6-3/4 x 9 inch view area (19 inch package). Provides bright point plot displays.

COMMUNICATIONS EQUIPMENT

ASYNCHRONOUS SINGLE LINE INTERFACES (DL11)
Connects PDP-11 systems to a variety of communication channels. Features include double character-buffered receiver and transmitter, selectable data rates (between 50 and 9600 baud), independent receive and transmit speeds, strap selectable character size and stop code length, 20 mA or EIA output levels, and optional full dataset control.

PROGRAMMABLE ASYNCHRONOUS DUAL LINE INTERFACE (DC11)
Interfaces local or remote terminals (via modems or datasets) to PDP-11 systems. Full or half duplex operation at 4 programmable line speeds. Split speed operation. Programmable character size: 5, 6, 7, or 8 bits. Automatic parity checking. Auto-answering capability. Interfaces to Bell 103, 202 or equivalent datasets. Reverse channel available for Bell 202 operation.

ASYNCHRONOUS 16-LINE INTERFACE (DM11)
Interfaces local or remote terminals (via modems or datasets) to PDP-11's. Up to 16 DM11's per PDP-11 for a total of up to 256 full duplex lines. Full or half duplex operation at rates up to 1200 baud. Characters assembled in, and messages transmitted from, core memory (DMA). Character size is jumper-selectable: 5, 6, 7, or 8 bits. Incoming characters receive automatic parity check, break detection, reverse break generation and are buffered in a 64 character "tumble" table. Modem control and various line drivers are optional.

SYNCHRONOUS LINE INTERFACE (DP11)
Interfaces high speed local or remote terminals or other computers to PDP-11's. Provides double buffering, full or half duplex operation, and programmable "sync" character and "sync" character stripping. Character size is programmable: 6, 7, or 8 bits. Auto-answering capability. Interfaces to Bell 201 and 303 or equivalent datasets. Internal clock is optional.

AUTOMATIC CALLING UNIT INTERFACE (DN11)
Provides computer control of Bell 801A, 801C or equivalent Automatic Calling Units.

SIGNAL CONDITIONING INTERFACES (DF11)
DF11 signal conditioning options permit most DIGITAL serial line interfaces to adapt to any of the common communications levels such as 20 mA teletype or EIA. The options include both the electrical conversion circuitry and the physical electrical connectors. One DF11 model incorporates an internal modem so that dataset requirements can be bypassed.

COMMUNICATIONS ARITHMETIC OPTION (KG11-A)
Computes cyclic redundancy checks (CRC) and longitudinal redundancy checks (LRC) for detecting errors in serially transmitted data.

INDUSTRIAL INTERFACES

ANALOG SCANNER SYSTEM (AFC11)
A true industrial subsystem for low level differential analog inputs. Expands to 1024 channels. High noise rejection.

UNIVERSAL DIGITAL CONTROLLER (UDC11)
Handles discrete process input/output such as contacts, relays, switches, pushbuttons, drivers for lamps or solenoids, counters and analog outputs. Expands to 4096 points.

ANALOG TO DIGITAL CONVERSION SUBSYSTEM (AD01-D)
Handles single-ended high level analog inputs. Optional bipolar with automatic sign. 10-bit precision. 14-bit resolution.

DIGITAL TO ANALOG CONVERTER (AA11-D)
Handles analog outputs. 11-bit precision plus sign. Bipolar output.

PDP-11 FAMILY SUMMARY

PDP-11/05 and PDP-11/15 let the original equipment manufacturer (OEM) tailor a machine to specific requirements. With the PDP-11/15, he can select consoles, specify the type and amount of memory, and choose from a variety of options such as power/fail restart, and single or multi-line interrupt capability. These options are standard on the PDP-11/05. Both machines are comparable to the PDP-11/20 in computational power and are UNIBUS and binary compatible with all PDP-11 family members.

PDP-11/10 is the lowest cost PDP-11 family member… a system whose low cost is due to a new packaging design and not to the elimination of essential features. The system includes as standard: hardware stacks, 8 general registers, hardware interrupt system, and a real-time clock. The system comes with 8K of core memory and can be expanded at any time with up to a full 28 K.

PDP-11/20 is one of the most widely accepted computers on the market today. With its flexible instruction set and word and byte addressing, the system is ideal for communications applications such as data concentration and message switching. It is also used in physics, biomedicine, education, industry, business, computation and research, serving in such widely diverse applications as order entry and spectroscopy.

PDP-11R20 is designed specifically for use in severe environments…to operate in moving vehicles, on ships and planes, and in environments where shock, vibration, motion and other factors might cause a less rugged computer to fail. It has all PDP-11/20 features plus a welded chassis, heavy duty fans, sealed switches, drip-proof construction and special clamps and reinforcing bars. The system's front panel is constructed of metal and is removable so that it can be operated remotely. The design is EMI protected throughout. Reports verifying conformance to various military specifications are available on request.

Operating Shock	5G, 11 msec	3 shocks in each direction on 3 mutually perpendicular axes (18 shocks).
Non-operating shock	15G, 11 msec	
Vibration	5-9 Hz, 1.0" double amplitude 9-500 Hz, 2.5G	vibration applied on 3 mutually perpendicular axes
Power Line Frequency	47 to 420 Hz	
Power Line Voltage	106, 118 VAC $\pm$10% 212, 224, 236 VAC $\pm$10%	
Operating Temperature	0° C to +55° C	
Non-operating Temperature	−55° C to +85° C	

PDP-11/45, the most powerful PDP-11 family member, is an excellent computation tool for large multi-user multi-task installations. Through memory management, memory can expand to 128 K which can include a combination of bipolar and MOS memory. MOS and bipolar memories are dual-ported so that computation can be overlapped for fast throughput. Other computation features include a greatly expanded floating point processor.

THE PDP-11/40 vs. CONVENTIONAL SYSTEMS

PDP-11	CONVENTIONAL
BUS	
Single asynchronous bus, the UNIBUS, means greater system efficiency, easier interfacing and expansion.	Two or more synchronous buses, separate for I/O and memory.
DIRECT MEMORY ACCESS	
Standard on all PDP-11's. Transfer rate: 5 million bytes per second.	Sometimes available as a costly option. Usually requires a separate DMA channel for each device.
POWER FAIL	
Standard. Guarantees program and equipment protection and automatic restart.	Usually extra cost option. Typically guarantees memory contents, nothing else.
HARDWARE STACKS	
Standard hardware feature on all models. Provides automatic temporary data storage. Improves efficiency, reduces programming costs.	Not normally available. Must be implemented by software at the expense of programming time, core memory space, and execution speed.
BYTE HANDLING	
Can operate on bits, bytes, words or multiwords. 17 basic byte instructions. All instructions operate on registers, memory locations or peripheral device registers.	Usually operates on single words—limited or no byte handling capability. Arithmetic instructions usually operate on accumulators only.
I/O INSTRUCTIONS	
No I/O instructions needed. All instructions operate on device registers. Simplifies programming.	Separate I/O instructions required for data transfers. Complicates and limits programming.
REGISTERS	
Eight general purpose registers. No special accumulators required. Registers may be used as accumulators, index registers or pointers.	Usually one or two index registers or one or two accumulators. Complicated register/accumulator schemes.
HARDWARE INTERRUPT SYSTEM	
Four levels allow multiple devices on each line.	Usually one level only with limited number of devices.
VECTORED INTERRUPTS	
Standard feature. Each device provides a direct vector to its own service routine. Automatically handled by hardware.	Software polling of I/O devices usually required.
MEMORY	
Memories of various speeds may be intermixed due to the system's asynchronous bus.	Machines that operate synchronously are restricted to a single memory speed.
PERIPHERALS	
DIGITAL is a single source for processors, memory, peripherals. More choices, better reliability, quantity discounts.	Most companies manufacture mainframes only. Choice of peripherals is frequently limited.
DISK OPERATING SYSTEM	
Modular structure. Large machine monitor concept. Supports many peripherals.	Limited modularity.
FORTRAN	
Large machine approach. Extended language capability. Random-access I/O.	Often requires additional memory or hardware. Limited to sequential I/O.

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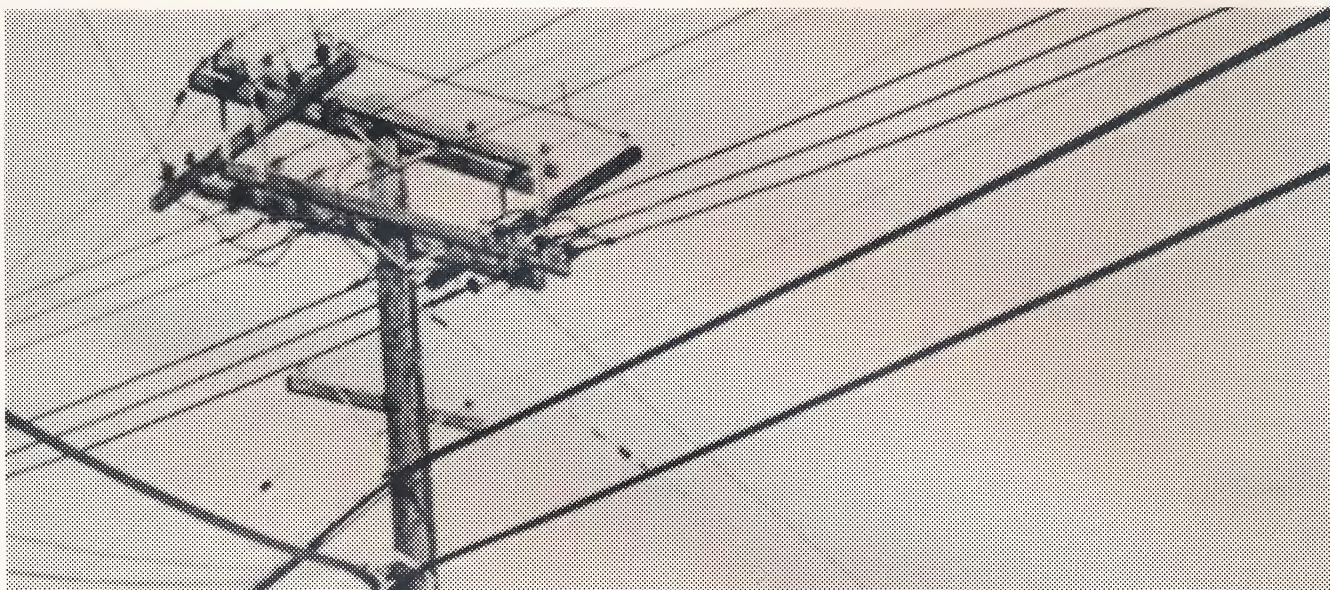
1972

DIGITAL EQUIPMENT CORPORATION

pdp11

DECcomm11 Price List

May 15, 1972

digital

DECcomm11 Systems

DECcomm11 systems are combinations of PDP-11 hardware and COMTEX (Communications Oriented Multi-Terminal EXecutive) software. Each system is intended as a base or a building block for data communications applications. Typically the user can add DIGITAL's line interfaces, terminals, mass storage devices, COMTEX programs, and his own application software.

At the heart of each DECcomm system is a PDP-11 16-bit processor, with built-in features which render it a natural choice for data communications applications. These features include:

- UNIBUS architecture which facilitates system expansion, addition of line adapters without multiplexing hardware, and interfacing of a wide variety of devices.
- A powerful instruction set which includes instructions for byte handling.

- An advanced multi-level priority interrupt structure which permits an almost unlimited number of devices to be added on each level.
- Dynamic stack capability associated with subroutine call and interrupt processing which permits reentrant coding and fully nested interrupts.

Complete pricing information on PDP-11 processors and hardware is available in the PDP-11 Price List.

APPLICATIONS

DECcomm systems can serve as the major building blocks in the following applications:

- message switchers
- data concentrators
- front end preprocessors
- computer network nodes
- remote job entry terminals

DECcomm11D20—COMMUNICATION SYSTEM BASE

This system is a PDP-11-based hardware/software package intended as a general-purpose building-block for many applications involving communication lines. With standard PDP-11 options, DECcomm 11D20 can be expanded to handle high-, medium-, and low-speed synchronous and asynchronous lines. Directly-addressable memory can be expanded to 28K words, and various mass storage devices and I/O terminals can be added. (See PDP-11/20 price list for full information).

11D20-CE

DECcomm11D20 Standard Components	
PDP-11/20 16-Bit Processor, consisting of:	
Central Processor	KA11
Programmer's Console	KY11-A
Basic Mounting Box and Power Supply	
72-Inch Cabinet	
8K-word, 900-nanosecond Core Memory	ME11-L
Real-time Clock	KW11-L
Teletype and Control	ASR33 and KL11*
COMTEX-11 Software: 16-terminal Interactive Teletype Package (includes COMTEX SCIP, Multi-terminal Interactive Teletype TAP, Asynchronous Line Interface ISR, 16-teletype Execute Module)	QJC20-AS
Paper Tape Software Package	LIBKIT-11/20

Discountable Under PDP-11 Discount Agreement: Type II

Training/Installation: Note A, Note B

*An alternative consisting of a DECwriter (LA30) Console Printer and High-speed Paper Tape Reader/Punch (PC11) is available.

Model Number	Basic I/O	Power	Price	Monthly Maint. Contract
11D20-CA	TTY	115V/60Hz	$16,400	$123
11D20-CB	TTY	230V/50Hz	$16,400	$123
11D20-CE	LA30/PC11	115V/60Hz	$20,600	$153
11D20-CF	LA30/PC11	230V/50Hz	$20,700	$153

DECcomm11D21—COMMUNICATION SYSTEM BASE (with IBM-2780 Bisync Emulation)

An expandable data entry system consisting of PDP-11 hardware and modular COMTEX-11 software, DECcomm11D21 is designed for users who want to expand standard IBM-2780-compatible remote job entry (RJE) operation to include PDP-11 peripherals or more versatile operational features.

DECcomm11D21 Standard Components

PDP-11/20 16-Bit Processor, Consisting of:	
Central Processor	KA11
Programmer's Console	KY11-A
Basic Mounting Box and Power Supply	
72-Inch Cabinet	
8K-word, 900-nanosecond Core Memory	ME11-L
Real-time Clock	KW11-L
Teletype and Control	ASR33 and KL11*
Synchronous Line Interface	DP11-DA
Communication Arithmetic Element	KG11-A
COMTEX-11 Software (Sources): IBM-2780 Emulator Application Package (Includes SCIP, Console Teletype TAP, Half-duplex Bisync TAP, Card Reader TAP and Line Printer TAP, DP11 Interrupt Service Routine, KL11 ISR, and 2780 Emulator Application Program)	QJC21-AS
Paper Tape Software Package	LIBKIT-11/20

Discountable Under PDP-11 Discount Agreement: Type II

Training/Installation: Note A, Note C, Note D, Note E

DECcomm11D21 Models Available

Model Number	Basic I/O	Power	Price	Monthly Maint. Contract
11D21-CA	TTY	115V/60Hz	$22,550	$147
11D21-CB	TTY	230V/50Hz	$22,550	$147
11D21-CE	LA30/PC11	115V/60Hz	$26,925	$177
11D21-CF	LA30/PC11	230V/50Hz	$27,025	$177

*An alternative consisting of a DECwriter (LA30) Console Printer and High-speed Paper Tape Reader/Punch (PC11) is available. Includes DD11-A.
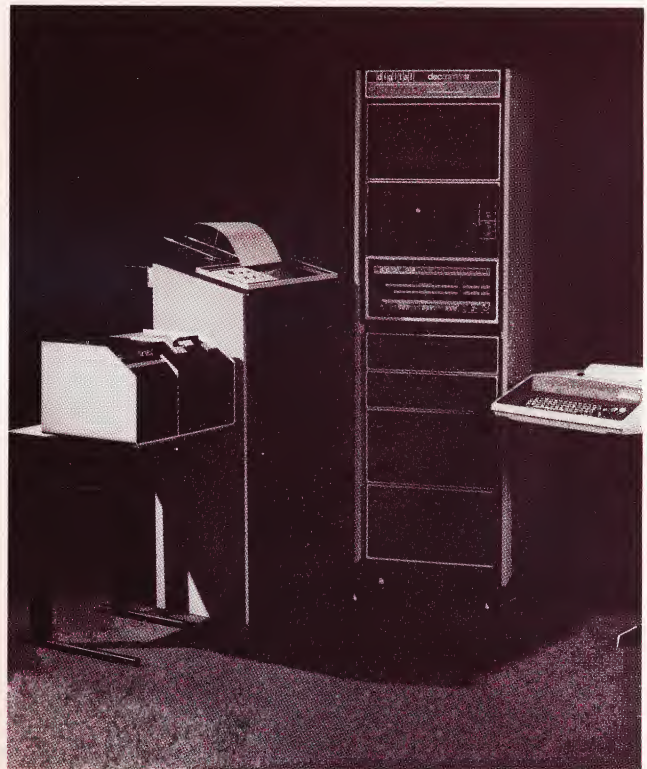
11D21-CE

Options

In order to configure a fully operational system, additional components must be added to the standard components. With models 11D21-CA, CB these devices require a DD11-A Mounting Panel ($175). Additional PDP-11/20 options may be added. (For more information, see PDP-11/20 price list.)

Card Reader (CR11A)	Reads 80-column punched cards at 300 cpm. Prices from $4,500.
Line Printer (LP11)	Prints 300 lpm; 80-column, 64 or 96 characters, or 132-column, 64 or 96 characters available. Prices from $12,000.
High-speed Paper Tape Reader/Punch (PC11)	Reads 300 cps, punches 50 cps. Price: $3,900.

DECcomm11D26—PDP-11/IBM-2780 REMOTE BATCH TERMINAL

A PDP-11-based system with turnkey IBM-2780 capability, DECcomm11D26 can read punched cards, transmit and receive records at data rates up to 4800 baud, and print formatted records. Operation is indistinguishable to IBM-OS/360 RJE Subsystem from an actual 2780 Data Transmission Terminal.

| DECcomm11D26 Standard Components	
PDP-11/20 16-Bit Processor, Consisting of:	
Central Processor	KA11
Programmer's Console	KY11-A
Basic Mounting Box and Power Supply	
72-Inch Cabinet	
8K-word, 900-nanosecond Core Memory	ME11-L
Teletype and Control	ASR33 and KL11*
Real-time Clock	KW11-L
Synchronous Line Interface	DP11-DA
Communication Arithmetic Element	KG11-A
COMTEX-11 Software (Binaries): 2780 Emulator Package	QJC21-AB
Paper Tape Software Package	LIBKIT-11/20

Discountable Under PDP-11 Discount Agreement: Type II

Training/Installation: Note A, Note D

DECcomm11D26 Models Available

Model Number	Basic I/O	Power	Price	Monthly Maint. Contract
11D26-CA	TTY	115V/60Hz	$17,550	$147
11D26-CB	TTY	230V/50Hz	$17,550	$147
11D26-CE	LA30/PC11	115V/60Hz	$21,925	$177
11D26-CF	LA30/PC11	230V/50Hz	$22,025	$177

11D26-CE

Options

In order to configure a fully operational system, the additional components listed below must be added to the standard components. With models 11D26-CA, CB these devices require a DD11-A Mounting Panel ($175). For more information, see PDP-11/20 price list.

Card Reader (CR11A)	Reads 80-column punched cards at 300 cpm. Prices from $4,500.
Line Printer (LP11)	Prints 300 lpm; 80-column, 64 or 96 characters or 132-column, 64 or 96 characters available. Prices from $12,000.
High-speed Paper Tape Reader/Punch (PC11)	Reads 300 cps; punches 50 cps. Price: $3,900.

*An alternative consisting of a DECwriter (LA30) Console Printer and High-speed Paper Tape Reader/Punch (PC11) is available. Includes DD11-A.

COMMUNICATIONS SOFTWARE

COMTEX-11 Software may be licensed at the prices listed below. This software is offered in four categories: the System Control and Interface Program (SCIP), Terminal Application Programs (TAP), Interrupt Service Routines (ISR), and Application Packages. The price for "Binaries" includes binary tapes and manuals. This price is for one copy of the software for use on a single machine. No reproduction of the tape for other machines is permitted.

The price for "Sources" includes source tapes, binary tapes, manuals and listings, and reproduction rights of binaries only. The sources may only be used on the machine on which the software was purchased. Reproduction of sources or DIGITAL-supplied binaries is not permitted. Reproduction of customer-created binaries is permitted. Binaries or Sources are designated by the -B or -S suffix.

Discountable Under PDP-11 Discount Agreement: Type II

System Interface and Control Program (SCIP)	QJ20-AS	$1,400
DM11 ISR	QJD20-AS	300*
DP11 ISR	QJD21-AS	300*
KL11 ISR	QJD22-AS	300*
DC11 ISR	QJD23-AS	300*
Multi-terminal Interactive Teletype TAP	QJD50-AS	1,100
IBM-2741 TAP	QJD51-AS	1,300
Binary Synchronous TAP	QJD52-AS	2,000
CR11 Card Reader TAP	QJD53-AS	500
LP11 Line Printer TAP	QJD54-AS	500
DN11 Autodialing TAP	QJD55-AS	200
Single-terminal Console Teletype TAP	QJD57-AS	100
16-terminal Interactive Teletype Package (Includes QJ20-AS, QJD50-AS, QJD23-AS, and 16-teletype Execute Module QJE20-AB).	QJC20-AS	2,500
IBM-2780 Emulator Software Package with source listings and binary tapes (Includes QJ20-AS, QJC21-AB, QJD53-AS, QJD54-AS, QJD52-AS, QJD22-AS, QJD21-AS, QJD57-AS, and 2780 Emulator Application Program—QJE21-AS**). (See Notes D and E for installation information.)	QJC21-AS	6,500
IBM-2780 Emulator Software Package with operating manual and binary tapes. (See Note D.)	QJC21-AB	1,500

*Provided free-of-charge on request when purchasing SCIP.
**QJE21-AS is available only with QJC21-AS.

TRAINING/INSTALLATION

Note A   Four weeks PDP-11/20 training.

Note B   Three days COMTEX-11 System Control and Interface Program training.

Note C   Three days COMTEX-11 System Control and Interface Program training and two days COMTEX-11 Bisync Terminal Application Program training.

Note D   One day on-site installation, including demonstration of system with supplied Test Job Stream and operation training. Required PDP-11 components include DP11-DA, KG11-A, CR11, LP11 and a minimum of 8K words memory.

      The customer must provide all transmission facilities including modems, leased communication lines (or access arrangement to switched network), and termination of the transmission facility to the appropriate IBM adapter. In addition, the customer is expected to perform any IBM/360 or 370 SYSGEN or software updates necessary to support standard IBM-2780-compatible RJE operation, and to supply any JCL (job control language) statement cards unique to his 360/370 Application Programs.

Note E   For multiple installations, DIGITAL will install the COMTEX-11 Binary package (QJC21-AB) as specified in Note D for $500 per installation.

PDP-11 Communications Hardware
(See PDP-11 Price List)

DL11   Single Asynchronous Line Interfaces
DC11   Dual Programmable Line Interfaces
DM11   16-Line Asynchronous Interfaces
DP11   Full/Half Duplex Synchronous Line Interfaces
DN11   Autodial Unit Interfaces
KW11   Real-Time Clocks
KG11   Communications Arithmetic Option
DC08   Telegraph Line Interfaces
H312A   Asynchronous / Synchronous Null Modem

TYPICAL DECcomm 11D26 CONFIGURATION

NOTES

1972

DIGITAL EQUIPMENT CORPORATION

pdp11/20

April 1, 1972.

Price List

new!

RKO5 DEC PACK

new!

ME11-L MEMORY SYSTEM

SEE PAGE 1

digital

NEW MEMORY SYSTEM (ME11-L)

DECPACK (RK05)

NEW High Performance Low Cost Cartridge Disk Drive

The RK05 DEC Pack—Designed and Built by DEC—Low Cost Random–Access Mass Storage—1.2 million words per drive.

Track-to-Track access time—10 msec; Average Random Move 50 msec; Total average access time 70 msec; 11.08 μsec transfer rate—Completely supported by the PDP-11 Disk Operating Systems and other standard PDP-11 software. Discountable under all standard DEC Discount Agreements—See following pages for new low cost PDP-11 Disk Operating System configuration making use of the NEW DEC Pack.

$5100

NEW PDP-11 MEMORY SYSTEM

The ME11-L Memory System provides 900 nanosecond PDP-11 core memory at lowest price ever! The Memory System is a self contained, rack mountable unit containing power supply and back panel for up to 24K of 16-bit 900 nanosecond read/write core memory in 8K increments. First 8K x 16 memory and UNIBUS cable included with Memory Box. Makes available additional systems units and power capability in the processor basic mounting box previously used for memory. Compact...only 5¼" high front panel conserves rack space....Another applications oriented product for the PDP-11 to make your system less expensive...Made by DEC with the support and service that implies...available now!

ME11-LA   Memory System—5¼" high rack mounted unit including power supply and back panel for up to 24K of 900 nsec core memory in 8K increments. First 8K of core and Unibus cable included. For 115V, 60Hz operation.

$5,200

ME11-LB   Memory System—Same as above except 230V, 50Hz.

$5,200

MM11-L   Memory—8K words of 16-bit Read/Write Core Memory—900 nsec cycle time—for use with ME11-L Memory System.

$4,400

NEW SYSTEM BUILDING BLOCKS

SYSTEM #1

11/21-CA
- 11/20, (KA11)—Central Processor with multilevel Automatic Priority Interrupt System and Power Fail and Automatic restart.
- KY11A Programmer's Console with Panel Lock and Switch.
- Basic Processor Mounting Box and Power Supply, Rack Mounted, slides and cabinet included.
- ME11LA—Memory System 900 nsec, 8K words by 16-bit Read/Write Core Memory.
- ASR-33 Teletype and Control (KL11A).
- Basic 8K Memory System for Maximum Expansion Capability—1 small peripheral controller slot and 3 system unit spaces available in processor box with 12.5 amps of additional +5 power—Memory System Box can accommodate additional 16K of core—Maximum economy—Maximum Expandability.

$13,650

11/21-CB   Same as above except for 230V, 50Hz operation.

$13,650

SYSTEM #2

11/21-CE
- 11/20, (KA11)—Central Processor with multilevel Automatic Priority Interrupt System and Power Fail and Automatic Restart.
- KY11-A Programmer's Console with Panel Lock/Switch.
- Basic Processor Mounting Box and Power Supply, Rack Mounted, slides and cabinet included.
- ME11-LA Memory System 900 nsec, 8K words 16-bit Read/Write Core Memory.
- PC11 High Speed Paper Tape Reader and Punch.
- LA30 DECwriter, 30 character per second, Console data terminal with control.

Basic 8K Memory System with High Speed Console I/O Specially Priced!—Provides expansion in both Processor Box and Memory System Box. 3 System Unit spaces with 11 amps of additional +5V power available for expansion in Processor Box.

System Price: $17,850

Previous price for comparable system was $20,745!

11/21-CF   Same as above except for 230V, 50Hz operation.

System Price: $17,950

SYSTEM #3

11/20-CE
- 11/20, (KA11)—Central Processor with multilevel Automatic Priority Interrupt System and Power Fail and Automatic restart.
- KY11-A Programmer's Console with Panel Lock/Switch Basic Mounting Box and Power Supply Rack Mounted, slides and cabinet included 115V, 60Hz.
- MM11F—4K 16-bit Read/Write Memory 950 nsec.
- PC11—High Speed Paper Tape Reader (300 cps) and punch (50 cps) with control 115V, 60Hz.
- LA30 DECwriter. 30-character per second low-cost data terminal with control.

Basic 4K System with High Speed Console I/O—Specially Priced!—Only $300 more than same system with Teletype Console I/O!—2 system unit spaces with 7.6 amps of +5V power available in processor box for expansion.

LIST PRICE $17,245
SPECIAL SYSTEM PRICE $15,650

11/20-CF   Same as above except for 230V, 50Hz operation.

LIST PRICE $17,345
SPECIAL SYSTEM PRICE $15,750

SOFTWARE—SUPPORTED PDP-11 SYSTEM CONFIGURATIONS
DISK OPERATING SYSTEMS

The PDP-11 Disk Operating System is a disk-resident software system which enables a PDP-11 user to efficiently develop and execute his programs. During program development, the monitor serves the user by providing a simple, easy-to-use interface with program development software such as the relocating assembler, FORTRAN Compiler, Editor, etc. During program execution, the monitor eases the burden on the user program by providing common I/O device handling routines, loaders, operator interface, and basic resources accounting. The Disk Operating System offers modular design for extreme flexibility, random access and sequential files, file protection, simultaneous I/O with processing and user access to a complete set of Monitor subsystems.

FORTRAN IV

FORTRAN IV is a full ANSI standard Compiler which operates under the PDP-11 Disk Operating System (DOS). In addition, the PDP-11 FORTRAN includes language elements which permit compatibility with IBM 1130 FORTRAN Programs. The many language extensions permit random access I/O, mixed mode arithmetic, and generalized expressions are allowed as array subscripts. PDP-11 FORTRAN IV will provide up to 24-bit accuracy for two-word formats (real) or up to 56-bit accuracy for four words (double precision).

The following example configurations are required to run the Disk Operating System and FORTRAN. The Disk Operating System and FORTRAN are provided at no charge with any of these configurations.

For assembly language programming the 8K DOS Systems are quite adequate. However, for FORTRAN it is recommended that memory size be increased to 12K or to 16K to enable execution of larger core resident programs.

POWERFUL NEW LOW COST DISK OPERATING SYSTEM
Configuration VI

This system provides the flexibility and convenience of a removable disk cartridge pack combined with high speed console I/O capability:

    300 character per second Paper Tape Reader
     50 character per second Paper Tape Punch
     30 character per second Printer

16K of core makes possible execution of larger core resident programs. All at a new lower price made possible by the development of the *NEW* RK05 1.2 million word DEC pack Removable Disk Cartridge System and the New ME11L 900 nsec Read/Write Core Memory System.

- PDP-11/21-CE System #2 Building Block including 11/20 Processor NEW ME11L Memory System with 8K of 900 nsec core memory.
- High Speed Paper Tape Reader and Punch.
- DECwriter Terminal.
- Cabinet.
- MM11L—additional 8K of 900 nsec core memory for use in ME11L Memory Box—for a total of 16K of memory in system.
- RK11/RK05 1.2 million word DEC pack Disk and Control with cabinet.
- BM792-YB ROM Bootstrap Loader.
- DD11-A Peripheral Mounting Panel for BM792-YB.

Available for future expansion: 3 small peripheral controller slots, 2 system unit spaces and 10.7 amps of +5V power.

System Price Software Included: $33,725

A 22% price reduction below previously available comparable system

CONFIGURATION I—DISK OPERATING SYSTEM

The reliability and speed of a large fixed-head disk are combined with DECtape—an inexpensive means of storing large amounts of file-structured data, both on-line and off-line.

OLD

Configuration I

- PDP-11/20CA; extra 4K core (8K total); with cabinet and Teletype.
- RF11/RS11 256K-word, DEC Disk and Control.
- TC11/TU56 Dual DECtape Transport and Control.
- BM792-YB ROM Bootstrap Loader.

System Price Software Included: $37,950

NEW

Configuration I-A

- PDP-11/21-CA System #1 Building Block including ME11L Memory with 8K 900 nsec core, cabinet and Teletype.
- RF11/RS11 256K-word, DEC Disk and Control.
- TC11/TU56 Dual DECtape Transport and Control.
- BM792-YB ROM Bootstrap Loader.
- Available for future expansion: 3 system unit spaces and 12.2 amps of +5V power in processor box; memory system can accommodate 16K of additional memory.

System Price Software Included: $36,650

A $1,300 reduction with faster core plus more room for expansion.

Configuration I-B

Same as Configuration I-A above except teletype is replaced by LA30—30 character per second DECwriter.

System Price Software Included: $36,950

An LA30 DECwriter for only $300 additional!

2

CONFIGURATION II—DISK OPERATING SYSTEM

This configuration is a lower cost alternate to Configuration I. It is intended for applications not requiring a large amount of removable storage. The New Configuration II-B includes high speed console I/O with 300 cps Paper Tape Reader and 30 cps Hard Copy Terminal.

OLD
Configuration II
- PDP-11/20-CA extra 4K core, 950 nsec (8K total); with Cabinet and Teletype.
- RF11/RS11 256K-word DEC Disk and Control.
- PC11 High-Speed Paper Tape Reader and Punch.
- BM792-YB ROM Bootstrap Loader.
- DD11-A Peripheral Mounting Panel for BM792-YB.

List Price: $33,325

NEW
Configuration II-B
- PDP-11/21-CE System #2 Building Block including ME11-L Memory System with 8K core 900 nsec, High Speed Paper Tape Reader and Punch—LA30 DECwriter Console Data Terminal and Cabinet.
- RF11/RS11 256K-word DEC Disk and Control.
- BM792-YB ROM Bootstrap Loader
- DD11-A Peripheral Mounting Panel for BM792-YB.

Available for future expansion: 3 small peripheral controller slots, 2 system unit spaces and 10.7 amps of +5V power in processor box. Memory System can accommodate 16K of additional core.

System Price Software Included: $32,325

A $1,000 reduction with faster core plus High Speed Console I/O. This Configuration is only $300 more than the equivalent system with a teletype console device.

Configuration II- A

Same as Configuration II-B above except DECwriter is replaced by ASR-33 teletype.

System Price Software Included: $32,025

CONFIGURATION III—DISK OPERATING SYSTEM

This configuration is based on a small, fast 64K fixed-head disk used for systems residency. The DECtape provides the media for on-line file, data or program storage. Off-line storage is also provided by the removable DECtapes. Low cost core expansion is available to 24K making use of new ME11-L Memory included in Configuration III-A and III-B.

OLD
Configuration III
- PDP-11/20-CA extra 4K core, 950 nsec (8K total); with Cabinet and Teletype.
- RC11/RS64 64K-word Disk and Control.
- TC11/TU56 Dual DECtape Transport and Control.
- BM792-YB ROM Bootstrap Loader.

List Price: $30,900
System Package Price Software Included: $29,900

NEW
Configuration III-A
- PDP-11/21-CA System #1 Building Block including ME11-L Memory System with 8K core 900nsec, Cabinet and Teletype.
- RC11/RS64 64K-word Disk and Control.
- TC11/TU56 Dual DECtape Transport and Control.
- BM792-YB ROM Bootstrap Loader.

Available for expansion: 3 system unit spaces and 12.2 amps of +5V available power in processor box. Memory System can accommodate 16K of additional core.

System Price Software Included: $29,600

Configuration III-B
- Same as Configuration III-A above, except Teletype is replaced by LA30—30 cps DECwriter.

System Price Software Included: $29,900

An LA30 DECwriter for only $300 additional!

CONFIGURATION IV—DISK OPERATING SYSTEM

This system combines the flexibility of a disk system with the convenience of a removable disk cartridge pack. It is particularly well suited for applications where several groups use and share the same system. Each group can easily maintain their files independently of the others. Development of the NEW DEC designed and manufactured RK05 1.2 million word DEC pack Disk System and the NEW DEC designed and manufactured ME11L Memory System have made possible the low price of the removable-disk-pack operating system with the low cost core expansion inherent in ME11L System.

OLD

Configuration IV

- PDP-11/20-CA extra 8K core 950 nsec (12K total) with Cabinet and Teletype.
- RK11/RK03 1.2 million word DECpack Disk and Control with Cabinet.
- TC11/TU56 Dual DECtape Transport and Control.
- BM792-YB ROM Bootstrap Loader.

System Price Software Included: $41,350

NEW

Configuration IV-A

- PDP-11/21-CA System #1 Building Block including ME11L Memory System with 8K 900 nsec of Core Memory, Cabinet and Teletype.
- RK11/RK05 1.2 million word DECpack Disk and Control with Cabinet.
- TC11/TU56 Dual DECtape Transport and Control.
- BM792-YB ROM Bootstrap Loader.

Available for expansion: 3 system unit spaces and 12.2 amps of +5V power available in processor box. Memory system can accommodate 16K of additional memory.

System Price Software Included: $38,050

A $3,300 REDUCTION!

Configuration IV-B

Same as Configuration IV-A above except Teletype is replaced by LA30—30 cps DECwriter.

System Price Software Included: $38,350

An LA30 DECwriter for only $300 additional!

CONFIGURATION V—DISK OPERATING SYSTEM

This system has the flexibility and convenience of a removable disk cartridge pack; the additional fixed-head disk increases system throughput; the DECtape provides an inexpensive means of providing large amounts of off-line structured data storage.

OLD

Configuration V

- PDP-11/20; extra 950 nsec 8K core (12K total) with cabinet and Teletype.
- RK11/RK03 1.2 million word DECpack Disk and Control and cabinet.
- RC11/RS64 64K fixed head DEC Disk and Control.
- TU11/TU56 Dual DECtape Transport and Control.
- BM792-YB ROM Bootstrap Loader.

System Price Software Included: $48,300

NEW

Configuration V-A

- PDP-11/21-CA #1 System Building Block including ME11L Memory System with 8K, 900 nsec memory, cabinet and teletype.
- MM11L 8K 900 nsec memory additional 8K to bring system total to 16K.
- RK11/RK05 1.2 million word DECpack Disk and control and cabinet.
- RC11/RS64 64K fixed head DEC Disk and control.
- TC11/TU56 Dual DECtape Transport and Control.
- BM792-YB ROM Bootstrap Loader.

Available for expansion: 3 system unit spaces and 12 amps of +5V power in processor box; memory system can accommodate 8K of additional memory.

System Price Software Included: $45,000

A $3,300 REDUCTION!

Configuration V-B

Same as configuration V-A above except teletype is replaced by LA30—30 cps DECwriter.

System Price Software Included: $45,300

An LA30 DECwriter for only $300 additional!

RSTS-11 RESOURCE TIMESHARING SYSTEM BASIC-PLUS

A powerful multi-task, in-house timesharing system that can support up to 16 independently controlled on-line interactive terminals. Every RSTS terminal user may have exclusive use of any peripheral on the system, uses up to 16,000 bytes of memory capacity, and have the ability to open and access up to 12 data files at any one time. Data files are stored on disk units with a file capacity of up to 32,000,000 bytes.

RSTS-11 users BASIC-PLUS, a greatly enriched version of the popular timesharing language.

Key features of BASIC-PLUS, include character string handling capability, extended program statement coding, print formatting, and operators to handle matrices, files and integers.

RSTS-11 is a highly configurable and flexible system. The system can be expanded or reconfigured at any time as needs grow. A minimum system, expanded by the addition of Teletypes or other terminals to 16 users, is as follows:

OLD
Configuration RSTS I
- PDP-11/20-CA with total of 24K core, cabinet and console teletype.
- RF11/RS11 256K DECdisk and Control.
- TC11/TU56 Dual DECtape Transport and Control.
- KW11-L Real-Time Clock.
- BM792-YB DECtape ROM Bootstrap Loader.
- 2 BA11-ES Extension Mounting Boxes.
- 2 H720 Power Supplies.
- DD11-A Mounting Unit for KL11 Interfacing.

Total System Package Price with supporting software including BASIC-PLUS: $54,375

Configuration RSTS I-A

Modify RSTS I above as follows:

Substitute: RC11/RS64 64K word DECdisk and control for RF11/RS11.

ADD: RK11/RK03 1.2M word Removable Disk Cartridge System.

NOTE: Limited to seven (total) simultaneous users.

Total System Package Price with supporting software: $61,225

NEW RSTS-11 Resource Time Sharing Systems
Configuration RSTS-2
- PDP-11/21-CA System #1 Building Block.
- 2 MM11L—Memory—8K, 900 nsec read/write for use in ME11L DEC Memory System brings total system core to 24K.
- RF11/RS11 256K DECdisk and Control.
- TC11/TU56 Dual DECtape transport and Control.
- KW11-L Real-Time Clock.
- BM792-YB DECtape ROM Bootstrap Loader.
- 1 BA11-ES Extension Mounting Box to accommodate user terminal interfaces.
- 1 H720 Power Supply.
- DD11-A Mounting Unit for KL11 Interfacing.

Total system package price with supporting software including BASIC-PLUS: $46,825

A reduction in price of $7,550 below comparable system previously available!

Configuration RSTS-2A

Modify RSTS-2 above as follows:

Substitute: RC11/RS64 64K word DECdisk and control for RF11/RS11.

ADD: RK11/RK05 1.2M word Removable Disk Cartridge System.

NOTE: Supports up to seven (total) simultaneous users: Addition of a second RS64 allows support of up to 16 simultaneous users.

Total system package price with supporting software including BASIC-PLUS: $50,825

A reduction in price of $10,400

Options available include:
- Additional core, disks, industry-compatible magnetic tape and dual DECtapes transports.
- Local and remote terminals and terminal interfaces, line printer, high speed paper-tape reader and punch, and punched card reader.

Ordering Note:

All Disk Operating and Resource Timesharing Systems described above have been configured for 115V, 60Hz operation. When 230V, 50Hz operation is required, those configurations which make use of Building Blocks Systems #2 and #3 must be increased in price by $100. Configurations which use System #1 are the same price for both 115V, 60Hz and 230V, 50Hz operation.

COMTEX-11 COMMUNICATIONS SYSTEMS AND SOFTWARE

See DECcomm 11 price list for further information on PDP-11 communication systems and software.

The COMTEX-11 data communications software system provides handlers for DEC-supplied communication line controllers and terminals. COMTEX-11 is a significant part of any software system for message switching, remote batch, concentrators, front ends, etc.

RSX-11C REAL-TIME SHARING EXECUTIVE

RSX-11C is a software package that coordinates the execution of tasks in a multi-programming mode in the PDP-11 family of computers. RSX-11C provides task scheduling, input/output, operator communication, and other functions for real-time multi-programmed operation.

User tasks or programs can be written to operate under the control of RSX-11C using either PAL-11 assembler programs of FORTRAN IV programs compiled under the Disk Operating System.

The handling of program scheduling and input/output by the real-time monitor makes it possible to use high-level languages such as FORTRAN IV. Combining FORTRAN IV with a general purpose real-time executive provides a software environment to make the PDP-11 a practical real-time operational tool for the process engineer, test engineer, or researcher.

Minimum configuration that will support RSX-11C
- PDP-11/20 with 12K core, cabinet and console teletype.
- KW11-L Real-Time Clock.
- PC11 High-Speed Paper Tape Reader and Punch.

This configuration can be expanded to 28K of memory and peripherals such as a Line Printer or DECtape can be added at any time.

MODEL DESIGNATION TABLE

	Rack Mountable	Table Top	Cabinet	TTY	LA30 PC11	4K Core	
11/20-AA	x			x		x	115V
-AB	x			x		x	230V
11/20-BA		x		x		x	115V
-BB		x		x		x	230V
11/20-CA			x	x		x	115V
-CB			x	x		x	230V
11/20-CE			x		x	x	115V
-CF			x		x	x	230V
						8K Memory System	
11/21-CA			x	x		x	115V
-CB			x	x		x	230V
11/21-CE			x		x	x	115V
-CF			x		x	x	230V

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Type Number	Description	Prerequisites	Price	Mounting Code See New Mounting Codes	Power Requirements See Note 6	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
PDP-11/20	Computer Consisting of: (1) KA11 Central Processor (1) 4K 16-bit Read/Write Memory (950 ns) (1) KY11A Programmer's Console (1) Basic Mounting Box and Power Supply (1) ASR-33 Teletype and Control (KL11A)	None		13.0	110			Note 3 or 4
PDP-11/20-AA	Above—rack mountable, slides included 115V 60Hz		10,800					
PDP-11/20-AB	Same except 230V 50Hz		10,800					
PDP-11/20-BA	Above—table top model, cover included 115V 60Hz		10,800					
PDP-11/20-BB	Same except 230V 50Hz		10,800					
PDP-11/20-CA	Above—rack mounted, slides and cabinet included 115V 60Hz		11,450					
PDP-11/20-CB	Same except 230V 50Hz		11,450					

For NEW PDP-11 Systems—See Pages 1 - 5

CORE STORAGE

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
ME11-LA	Memory System-16 Bit read/write 900nsec core, self contained in 5¼" rack-mountable unit, includes power supply, back panel (wired for up to 24K), first 8K increment and Unibus cable. (Expandable to 24K in 8K increments *only*) 115V 60Hz.	PDP-11	5,200	SM. PAN.	3.0	35	150	Note 2 or 4
ME11-LB	Same as above 230V 50Hz	PDP-11	5,200	SM. PAN.	3.0	35	150	
MM11-L	8K words of 16-bit read/write core memory 900 nsec cycle time for use with ME11-L Memory Box only. Mounts in ME11-L.	ME11-L A or B	4,400		0.0	35	150	Note 2 or 4
MM11-E	4K Words of 16-bit Read/Write Core Memory— 1.2μs cycle time; includes system unit and Unibus connector	PDP-11	3,000	1 SU	3.4	25	150	Note 2 or 4
MM11-F	4K Words of 16-bit Read/Write Core Memory— 950nsec cycle time; includes systems unit and Unibus connector. Supplied interleaved if ordered in multiples of 8K. **Interleaved Memory...**Increases effective memory speed by alternate addressing and overlapping read/write cycles in independent banks of 4K memories. Available in multiples of 8K words.	PDP-11	3,500	1 SU	3.4	25	150	Note 2 or 4
MM11-EX	8K Words Interleaved Memory; 900 nsec cycle time.	PDP-11	6,000	2 SU	6.5	40	180	Note 2 or 4
MM11-FX	8K Words Interleaved Memory; 490 nsec cycle time when transferring into memory; 800 nsec cycle time when transferring out of memory.	PDP-11	7,000	2 SU	6.5	40	180	Note 2 or 4

DIODE MEMORY

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
M792	*32-Word Read-Only Diode Memory; customer programmable by the removal of selected diodes.*	PDP-11	300	SPC	.3	3		Note 5
BM792-YA	Paper-tape (TTY or a High-Speed Reader) Bootstrap Loader	PDP-11	300	SPC	.3	3	50	Note 3 or 4
BM792-YB	Bulk Storage Bootstrap Loader (Disc or DECtape)	PDP-11	300	SPC	.3	3	50	Note 3 or 4
BM792-YC	Card Reader Bootstrap Loader (CR11)	PDP-11	300	SPC	.3	3	50	Note 3 or 4

MAGNETIC TAPE
DECtape

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
TC11	Controller for up to Four TU56 DECtape Transports, includes cabinet	PDP-11	4,000	CAB	0.0	12	240	Note 3 or 4
TU56	Dual DECtape Transport 115/230V, 50/60Hz	TC11	4,700		0.0	30	60	Note 3 or 4

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Type Number	Description	Prerequisites	Price	Mounting Code See New Mounting Codes	Power Requirements See Note 6	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status

INDUSTRY-COMPATIBLE MAGNETIC TAPE

Vacuum-column buffered Tape Transport and Control for either 7- or 9-channel, ½-inch industry-compatible magnetic tape: 800 BPI, 45 IPS (7-channel model also has provision for 556 and 200 BPI, program selectable). Up to seven additional slave tape transports may be added to each master transport and control. Cabinet included.

The following configurations are available:

	115V, 60Hz	230V, 50Hz
Control Unit	TM11-A	TM11-B
9-track Master Transport	TU10-EA	TU10-ED
9-track Slave Transport	TU10-EE	TU10-EJ
7-track Master Transport	TU10-FA	TU10-FD
7-track Slave Transport	TU10-FE	TU10-FJ

Type Number	Description	Prerequisites	Price	Mounting Code	Power Req.	Monthly Maint.	Field Install.	Discount Status
TU10	7- or 9-Channel, Master or Slave Transport (select model designation from above).	PDP-11 TM11	6,950	CAB	0.0	70	400	Note 3 or 4
TM11	Tape Controller for up to eight TU10 Transports (select model designation from above).	PDP-11	3,000		0.0	25	240	Note 3 or 4

ROTATING MEMORY

Type Number	Description	Prerequisites	Price	Mounting Code	Power Req.	Monthly Maint.	Field Install.	Discount Status
RS64	64K-Word DECdisk Fixed-Head Disk Drive; 16 μsec/word transfer rate; 16.1 msec average access time. Expandable to 262K words. (Does not include cabinet).	PDP-11 RC11	4,500	PAN	0.0	15	240	Note 3 or 4
RS64-A	Same as above; for 230V, 50Hz.	PDP-11 RC11	4,500		0.0	15	240	Note 3 or 4
RC11	Controller for up to four RS64 DECdisks.	PDP-11	2,450		0.0	20	150	Note 3 or 4
RS11	256K Word Fixed-Head Disk Drive; 16 μsec/word transfer; 17 msec average access time.	RF11	9,000		0.0	40	240	Note 3 or 4
RS11-A	Same as above; 230V 50Hz.	PDP-11 RF11	9,000		0.0	40	240	Note 3 or 4
RF11	Controller for up to 8 RS11 Disks (includes cabinet).	PDP-11	5,000	CAB	0.0	25	220	Note 3 or 4
RK03	1.2 million word DECpack Removable Disk Cartridge System 11.1 μsec/word transfer rate; 80 msec average seek time. Expandable to 9.6 million words.	PDP-11 RK11	8,000		0.0	60	260	NO
RK03-A	Same as above; for 230V, 50Hz.	PDP-11 RK11	8,000		0.0	60	260	NO
RK03-KA	1.2M-Word Disk Cartridge for the RK03 or RK05 Moving-Head Disks.	RK11/RK03/05	150		0.0			
RK05	1.2 million word DECpack Removable Disk Cartridge System 11.08 μsec/word transfer rate. 70 msec average access time. Expandable to 9.6 million words.	PDP-11 RK11	5,100		0.0	60	260	Note 2 or 4
RK05-A	Same as above; for 230V, 50Hz.	PDP-11 RK11	5,100		0.0	60	260	Note 2 or 4
RK11	Controller for up to 8 RK03 and/or RK05 DECpack disk cartridge drives (includes cabinet for up to 4 drives).	PDP-11	5,900	CAB	0.0	40	240	Note 3 or 4

EXTENDED ARITHMETIC ELEMENTS

Type Number	Description	Prerequisites	Price	Mounting Code	Power Req.	Monthly Maint.	Field Install.	Discount Status
KE11-A	Extended Arithmetic Hardware Element; Multiply, Divide, multiple shifts, normalizes—handles **signed** numbers.	PDP-11	1,800	1 SU	4.0	10	80	Note 3 or 4
KG11-A	Communications Arithmetic Element for rapid calculation of Cycle Redundancy Check (CRC) and Longitudinal Redundancy Check (LRC). Used to calculate and test Block Check Characters (BCC) required for synchronous communications.	PDP-11	750	SPC	1.5	6	60	Note 3 or 4

CARD EQUIPMENT

Type Number	Description	Prerequisites	Price	Mounting Code	Power Req.	Monthly Maint.	Field Install.	Discount Status
CR11	Card Reader; for 80-column punched cards; rate 300 cards per minute (table top).	PDP-11	4,500	SPC/ FS	1.5	50	240	NO
CR11-A	Same as above, 230V, 50Hz.	PDP-11	4,500						
CM11	Mark-Sense Card Reader; 40-column, 200 cards per minute.	PDP-11	4,900	SPC/ FS	1.5	50	240	NO
CM11-A	Same as above, 230V, 50Hz.	PDP-11	4,900						

Type Number	Description	Prerequisites	Price	Mounting Code See New Mounting Codes	Power Requirements See Note 6	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
CM11-A	Same as CM11, except 230V, 50Hz.	PDP-11	4,900					
CD11	Same as CR11, except 1000 cards per minute. Includes DMA interface.	PDP-11	10,000	1 SU FS	2.5	70	240	NO
CD11-A	230V, 50Hz model.	PDP-11	10,000					

CLOCKS

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
KW11-L	Real Time Clock—Line Frequency. Causes interrupt each 16.6 ms (60Hz) or 20 ms (50Hz).	PDP-11	250	MOD	.8	3	50	Note 3 or 4
KW11-P	Programmable Real Time Clock—Provides programmed realtime interval interrupts and interval counting. Program selectable count rates at 100 KHz, 10 KHz, line frequency or from external analog source. Interrupt interval is established by loading a register with a count, selecting the count rate counting down to zero, and then generating an interrupt.	PDP-11	600	SPC	1.0	3	50	Note 3 or 4

PAPER TAPE AND TELETYPE

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
PC11	High Speed Paper Tape Reader (300 cps) and Punch (50 cps) with control 115V, 60Hz.	PDP-11	3,900	SPC/PAN	1.5	30	320	Note 3 or 4
PC11-A	Same as PC11 except that it requires 115V, 50Hz; 230V requires H-722.	PDP-11	3,900	SPC/PAN	1.5	30	320	Note 3 or 4
PR11	High Speed Paper Tape Reader (300 cps) with Control 115V, 50/60Hz, 230V requires H-722.	PDP-11	2,400	SPC/PAN	1.5	15	150	Note 3 or 4
H-722	Transformer 230V to 115V 50/60Hz required for 230V operation of PC11 and PR11.	PC11 or PR11	100		0.0			Note 3 or 4
LA30-PA	DECwriter Data Terminal. 30-character per second low-cost data terminal. Hard copy original plus one copy on standard 9⅞" tractor-driven paper. Extremely low noise; very high reliability. Parallel input & output. 115V, 60Hz.	LC11-A	2,795	FS	0.0	30	120	Note 3 or 4
LA30-PD	Same as above; for 230V, 50Hz.	LC11-A	2,795		0.0	30	120	Note 3 or 4
LC11-A	Controller for LA30 DECwriter.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-A	Teletype Control for LT33 or LT35 including address select and interrupt control.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
LT33-DC	ASR-33 Teletype 115V, 60Hz.	KL11A	1,500	FS	0.0	30	130	NO
LT33-DD	ASR-33 Teletype 230V, 50Hz.	KL11A	1,500	FS	0.0	30	130	NO
LT33-CC	KSR-33 Teletype 115V, 60Hz.	KL11A	1,200	FS	0.0	25	80	NO
LT33-CD	KSR-33 Teletype 230V, 50Hz.	KL11A	1,200	FS	0.0	25	80	NO
LT35-DC	ASR-35 Teletype 115V, 60Hz.	KL11A	4,500	FS	0.0	25	150	NO
LT35-DD	ASR-35 Teletype 230V, 50Hz.	KL11A	4,500	FS	0.0	25	150	NO
LT35-CC	KSR-35 Teletype 230V, 60Hz.	KL11A	3,000	FS	0.0	22	80	NO
LT35-CD	KSR-35 Teletype 230V, 50Hz.	KL11A	3,000	FS	0.0	22	80	NO

LINE PRINTERS

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
LP11	300 lpm, line printer includes control logic			SPC	1.0			
LP11-FA	80 Col. Line Printer, 64 Char. 115V, 60Hz.	PDP-11	12,000	FS	0.0	60	200	NO
LP11-FB	80 Col. Line Printer, 64 Char. 230V, 50Hz.	PDP-11	12,000	FS	0.0	60	200	NO
LP11-HA	80 Col. Line Printer, 96 Char. 115V, 60Hz.	PDP-11	13,500	FS	0.0	65	200	NO
LP11-HB	80 Col. Line Printer, 96 Char. 230V, 50Hz.	PDP-11	13,500	FS	0.0	65	200	NO
LP11-JA	132 Col. Line Printer, 64 Char. 115V, 60Hz.	PDP-11	17,500	FS	0.0	75	250	NO
LP11-JB	132 Col. Line Printer, 64 Char. 230V, 50Hz.	PDP-11	17,500	FS	0.0	75	250	NO
LP11-KA	132 Col. Line Printer, 96 Char. 115V, 60Hz.	PDP-11	19,000	FS	0.0	80	250	NO
LP11-KB	132 Col. Line Printer, 96 Char. 230V, 50Hz.	PDP-11	19,000	FS	0.0	80	250	NO

INTERFACE EQUIPMENT

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
DR11-A	General-purpose digital interface to the PDP-11, permits bidirectional transfer of 16-bits in parallel from the user's device to the PDP-11 UNIBUS. Contains all necessary interrupt, address, and control signals to allow the user to interface directly to the PDP-11. Includes cable connectors.	PDP-11	400	SPC	1.5	5	75	Note 3 or 4

INDUSTRY-COMPATIBLE MAGNETIC TAPE

Vacuum-column buffered Tape Transport and Control for either 7- or 9-channel, ½-inch industry-compatible magnetic tape: 800 BPI, 45 IPS (7-channel model also has provision for 556 and 200 BPI, program selectable). Up to seven additional slave tape transports may be added to each master transport and control. Cabinet included.

The following configurations are available:

	115V, 60Hz	230V, 50Hz
Control Unit	TM11-A	TM11-B
9-track Master Transport	TU10-EA	TU10-ED
9-track Slave Transport	TU10-EE	TU10-EJ
7-track Master Transport	TU10-FA	TU10-FD
7-track Slave Transport	TU10-FE	TU10-FJ

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
TU10	7- or 9-Channel, Master or Slave Transport (select model designation from above).	PDP-11 TM11	6,950	CAB	0.0	70	400	Note 3 or 4
TM11	Tape Controller for up to eight TU10 Transports (select model designation from above).	PDP-11	3,000		0.0	25	240	Note 3 or 4

ROTATING MEMORY

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
RS64	64K-Word DECdisk Fixed-Head Disk Drive; 16 μsec/word transfer rate; 16.1 msec average access time. Expandable to 262K words. (Does not include cabinet).	PDP-11 RC11	4,500	PAN	0.0	15	240	Note 3 or 4
RS64-A	Same as above; for 230V, 50Hz.	PDP-11 RC11	4,500		0.0	15	240	Note 3 or 4
RC11	Controller for up to four RS64 DECdisks.	PDP-11	2,450		0.0	20	150	Note 3 or 4
RS11	256K Word Fixed-Head Disk Drive; 16 μsec/word transfer; 17 msec average access time.	RF11	9,000		0.0	40	240	Note 3 or 4
RS11-A	Same as above; 230V 50Hz.	PDP-11 RF11	9,000		0.0	40	240	Note 3 or 4
RF11	Controller for up to 8 RS11 Disks (includes cabinet).	PDP-11	5,000	CAB	0.0	25	220	Note 3 or 4
RK03	1.2 million word DECpack Removable Disk Cartridge System 11.1 μsec/word transfer rate; 80 msec average seek time. Expandable to 9.6 million words.	PDP-11 RK11	8,000		0.0	60	260	NO
RK03-A	Same as above; for 230V, 50Hz.	PDP-11 RK11	8,000		0.0	60	260	NO
RK03-KA	1.2M-Word Disk Cartridge for the RK03 or RK05 Moving-Head Disks.	RK11/RK03/05	150		0.0			
RK05	1.2 million word DECpack Removable Disk Cartridge System 11.08 μsec/word transfer rate. 70 msec average access time. Expandable to 9.6 million words.	PDP-11 RK11	5,100		0.0	60	260	Note 2 or 4
RK05-A	Same as above; for 230V, 50Hz.	PDP-11 RK11	5,100		0.0	60	260	Note 2 or 4
RK11	Controller for up to 8 RK03 and/or RK05 DECpack disk cartridge drives (includes cabinet for up to 4 drives).	PDP-11	5,900	CAB	0.0	40	240	Note 3 or 4

EXTENDED ARITHMETIC ELEMENTS

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
KE11-A	Extended Arithmetic Hardware Element; Multiply, Divide, multiple shifts, normalizes—handles **signed** numbers.	PDP-11	1,800	1 SU	4.0	10	80	Note 3 or 4
KG11-A	Communications Arithmetic Element for rapid calculation of Cycle Redundancy Check (CRC) and Longitudinal Redundancy Check (LRC). Used to calculate and test Block Check Characters (BCC) required for synchronous communications.	PDP-11	750	SPC	1.5	6	60	Note 3 or 4

CARD EQUIPMENT

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
CR11	Card Reader; for 80-column punched cards; rate 300 cards per minute (table top).	PDP-11	4,500	SPC/FS	1.5	50	240	NO
CR11-A	Same as above, 230V, 50Hz.	PDP-11	4,500					
CM11	Mark-Sense Card Reader; 40-column, 200 cards per minute.	PDP-11	4,900	SPC/FS	1.5	50	240	NO
CM11-A	Same as above, 230V, 50Hz.	PDP-11	4,900					

Type Number	Description	Prerequisites	Price	Mounting Code See New Mounting Codes	Power Requirements See Note 6	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
CM11-A	Same as CM11, except 230V, 50Hz.	PDP-11	4,900					
CD11	Same as CR11, except 1000 cards per minute. Includes DMA interface.	PDP-11	10,000	1 SU FS	2.5	70	240	NO
CD11-A	230V, 50Hz model.	PDP-11	10,000					

CLOCKS

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
KW11-L	Real Time Clock—Line Frequency. Causes interrupt each 16.6 ms (60Hz) or 20 ms (50Hz).	PDP-11	250	MOD	.8	3	50	Note 3 or 4
KW11-P	Programmable Real Time Clock—Provides programmed realtime interval interrupts and interval counting. Program selectable count rates at 100 KHz, 10 KHz, line frequency or from external analog source. Interrupt interval is established by loading a register with a count, selecting the count rate counting down to zero, and then generating an interrupt.	PDP-11	600	SPC	1.0	3	50	Note 3 or 4

PAPER TAPE AND TELETYPE

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
PC11	High Speed Paper Tape Reader (300 cps) and Punch (50 cps) with control 115V, 60Hz.	PDP-11	3,900	SPC/PAN	1.5	30	320	Note 3 or 4
PC11-A	Same as PC11 except that it requires 115V, 50Hz; 230V requires H-722.	PDP-11	3,900	SPC/PAN	1.5	30	320	Note 3 or 4
PR11	High Speed Paper Tape Reader (300 cps) with Control 115V, 50/60Hz, 230V requires H-722.	PDP-11	2,400	SPC/PAN	1.5	15	150	Note 3 or 4
H-722	Transformer 230V to 115V 50/60Hz required for 230V operation of PC11 and PR11.	PC11 or PR11	100		0.0			Note 3 or 4
LA30-PA	DECwriter Data Terminal. 30-character per second low-cost data terminal. Hard copy original plus one copy on standard 9⅞″ tractor-driven paper. Extremely low noise; very high reliability. Parallel input & output. 115V, 60Hz.	LC11-A	2,795	FS	0.0	30	120	Note 3 or 4
LA30-PD	Same as above; for 230V, 50Hz.	LC11-A	2,795		0.0	30	120	Note 3 or 4
LC11-A	Controller for LA30 DECwriter.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-A	Teletype Control for LT33 or LT35 including address select and interrupt control.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
LT33-DC	ASR-33 Teletype 115V, 60Hz.	KL11A	1,500	FS	0.0	30	130	NO
LT33-DD	ASR-33 Teletype 230V, 50Hz.	KL11A	1,500	FS	0.0	30	130	NO
LT33-CC	KSR-33 Teletype 115V, 60Hz.	KL11A	1,200	FS	0.0	25	80	NO
LT33-CD	KSR-33 Teletype 230V, 50Hz.	KL11A	1,200	FS	0.0	25	80	NO
LT35-DC	ASR-35 Teletype 115V, 60Hz.	KL11A	4,500	FS	0.0	25	150	NO
LT35-DD	ASR-35 Teletype 230V, 50Hz.	KL11A	4,500	FS	0.0	25	150	NO
LT35-CC	KSR-35 Teletype 230V, 60Hz.	KL11A	3,000	FS	0.0	22	80	NO
LT35-CD	KSR-35 Teletype 230V, 50Hz.	KL11A	3,000	FS	0.0	22	80	NO

LINE PRINTERS

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
LP11	300 lpm, line printer includes control logic			SPC	1.0			
LP11-FA	80 Col. Line Printer, 64 Char. 115V, 60Hz.	PDP-11	12,000	FS	0.0	60	200	NO
LP11-FB	80 Col. Line Printer, 64 Char. 230V, 50Hz.	PDP-11	12,000	FS	0.0	60	200	NO
LP11-HA	80 Col. Line Printer, 96 Char. 115V, 60Hz.	PDP-11	13,500	FS	0.0	65	200	NO
LP11-HB	80 Col. Line Printer, 96 Char. 230V, 50Hz.	PDP-11	13,500	FS	0.0	65	200	NO
LP11-JA	132 Col. Line Printer, 64 Char. 115V, 60Hz.	PDP-11	17,500	FS	0.0	75	250	NO
LP11-JB	132 Col. Line Printer, 64 Char. 230V, 50Hz.	PDP-11	17,500	FS	0.0	75	250	NO
LP11-KA	132 Col. Line Printer, 96 Char. 115V, 60Hz.	PDP-11	19,000	FS	0.0	80	250	NO
LP11-KB	132 Col. Line Printer, 96 Char. 230V, 50Hz.	PDP-11	19,000	FS	0.0	80	250	NO

INTERFACE EQUIPMENT

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
DR11-A	General-purpose digital interface to the PDP-11, permits bidirectional transfer of 16-bits in parallel from the user's device to the PDP-11 UNIBUS. Contains all necessary interrupt, address, and control signals to allow the user to interface directly to the PDP-11. Includes cable connectors.	PDP-11	400	SPC	1.5	5	75	Note 3 or 4

Type Number	Description	Prerequisites	Price	Mounting Code See New Mounting Codes	Power Requirements See Note 6	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
DR11-B	General-purpose, direct-memory access interface to PDP-11. Moves data directly to or from user's device to memory at DMA speeds. Includes word count, current address, and data registers. Can also be used for high-speed processor-to-processor communication.	PDP-11	1,200	1 SU	3.2	12	75	Note 3 or 4
DD11-A	Peripheral Mounting Panel (includes UNIBUS Connector Module—M920). Prewired System Unit for 4 small peripheral controllers (one System Unit).	PDP-11	175	1 SU	0.0		50	Note 3 or 4
DB11-A	UNIBUS Repeater. Allows an additional 18 unit loads and an additional 50 feet of UNIBUS extension to be added to the PDP-11 system.	PDP-11 KH11-A	1,000	1 SU	2.2	5	75	Note 3 or 4
KH11-A	Large system capability option one required for each system having a Bus Switch or Bus repeater.	PDP-11	700		0.0	25*	300	Note 3 or 4
BB11	*Blank Mounting Panel—Wired for bus and power (Does not include UNIBUS connector Module—M920). For custom interface design and mounting System Units.*	None	90	1 SU	0.0			Note 5
M783	*UNIBUS Transmitter Module; UNIBUS to Device interface drivers, (12 drivers).*	None	30		0.0			Note 5
M784	*UNIBUS Receiver Module; UNIBUS to Device interface receivers, (16 receivers).*	None	30		0.0			Note 5
M785	*UNIBUS Transceiver Module; UNIBUS/Device interface drivers and receivers (8 receivers and 8 drivers).*	None	35		0.0			Note 5
M786	*General-Purpose Interface Module containing 16-bit Flip-Flop Register with bus receivers and transmitters.*	None	220		0.0			Note 5
M105	*Address Selector Module (4 Addresses).*	None	65		0.0			Note 5
M782	*Interrupt Control Module (2 interrupt capability).*	None	100		0.0			Note 5
M920	*UNIBUS Connector Module (Jumper module to interconnect System Units).*	None	45		0.0			Note 5
BC11A	*UNIBUS Cable* *Length*	None			0.0			
	BC11A-2 *2'*		90					Note 5
	BC11A-5 *5'*		100		0.0			Note 5
	BC11A-8F *8'6"*		105		0.0			Note 5
	BC11A-10 *10'*		110		0.0			Note 5
	BC11A-15 *15'*		125		0.0			Note 5
	BC11A-25 *25'*		160		0.0			Note 5

ANALOG TO DIGITAL

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
AD01-D	Analog to Digital Conversion Subsystem. 10-bit unipolar or 10-bit plus sign (optional) analog to digital converter, multiplexer control for up to 32 channels of single-ended, high-level inputs; with interface and power supply. Program selectable input ranges of: 0 to +1.25V, +2.5V, +5.0 or +10.0V unipolar; 0 to ±1.25V, ±2.5V, ±10.0V bipolar.	PDP-11	2,400	PAN	0.0	20	150	Note 3 or 4

Options—mount in AD01-D

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
A124	Mux Module 4 channels.	AD01-D	60		0.0	2	20	Note 3 or 4
AH04	Sample & Hold.	AD01-D	300		0.0	3	50	Note 3 or 4
AH05	Sign Bit, 11th Bit, 2's complement.	AD01-D	400		0.0	6	80	Note 3 or 4

*If KH11-A is present, maintenance contract must cover both central processor and KH11-A.

Type Number	Description	Prerequisites	Price	Mounting Code See New Mounting Codes	Power Requirements See Note 6	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
DIGITAL TO ANALOG								
AA11-D	Digital to Analog Converter Subsystem. 11-bits plus sign digital to analog conversion with up to 4 channels available with an adjustable full-scale output voltage of 0 to ±10V at 10 ma. Space available for 4 BA614.	PDP-11	1,000	1 SU	2.9	6	10	Note 3 or 4
BA614	Digital to Analog Converter—mounts in AA11-D.	AA11-D	375		0.0	5	30	Note 3 or 4
CRT DISPLAYS AND TERMINALS								
AA11-A	Control for 611 scope. Space available for 2 more BA614; mounts in AA11-D.	AA11-D+ (2) BA614	600	1 SU	2.9	4	20	Note 3 or 4
VT01-A	Tektronix 611 Storage Tube Display.	AA11-D AA11-A +(2) BA614	3,000	FS	0.0	75	60	NO
AA11-B	Control for RM503 Scope. Space available for 2 more BA614; mounts in AA11-D.	AA11-D+ (2) BA614	600	1 SU	2.9	4	20	Note 3 or 4
VR01A	Tektronix RM503 Oscilloscope Display Oscilloscope Display.	AA11-D+ AA11-B+ (2) BA614	1,000	PAN	0.0	14	90	NO
AA11-C	Control for VR14 Scope. Space available for 2 more BA614; mounts in AA11-D.	AA11-D (2) BA614	600	1 SU	2.9	4	20	Note 3 or 4
VR14	7" x 9" Point Plot Display.	AA11-D+ AA11-C+ (2) BA614	3,000	PAN	0.0	18	100	Note 3 or 4
VR14A	Same as above except 230V, 50/60Hz.	AA11-D+ AA11-C+ (2) BA614	3,000	PAN	0.0	18	100	Note 3 or 4
VT05-A	Alphanumeric CRT display with keyboard. Half- or full-duplex, 64/128 character set keyboard, 20 lines of 72 characters per line on screen size of 8¾" x 6⅝". Totally Teletype compatible at 110, 150, 03 300 Baud 115V, 60Hz.	PDP-11 KL11-A, B, C or DC11	2,795	FS	0.0	35	80	Note 3 or 4
VT05-D	Same as above; except 230V, 50Hz.				0.0			
COMMUNICATIONS								
ASYNCHRONOUS INTERFACES								
KL11-A	Full Duplex Asynchronous Line Interface Unit; 110 Baud.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-B	Same as KL11-A except 150 Baud.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-C	Same as KL11-B, except 300 Baud.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-D	Same as KL11-B, except 600 Baud.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-E	Same as KL11-B, except 1200 Baud send, 110 Baud receive.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-F	Same as KL11-A, except 2400 Baud.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
DE11-A	Line adaptor for EIA Level signal conversion send/receive only for connection to terminal devices.	KL11 Series	100		0.0	2	20	Note 3 or 4
DC11-AA	Dual Asynchronous Serial Line System Unit and Clock for mounting 2 DC11DA Module Sets. 110, 134.5, 150, 300 Baud (typical speeds with 103 modem, program selectable).	PDP-11	250	1 SU	0.0	3	50	Note 3 or 4
DC11-AB	Same as DC11-AA except 110, 300, 1200 and 1800 Baud (typical 202 speeds, program selectable).	PDP-11	250	1 SU	0.0	3	50	Note 3 or 4
DC11-AC	Same as DC11-AA except 110, 150, 600 and 1200 Baud (typical European, program selectable).	PDP-11	250	1 SU	0.0	3	50	Note 3 or 4
DC11-AD	Same as DC11-AA except 50, 110, 134.5, 150 Baud.	PDP-11	350	1 SU	0.0	3	50	Note 3 or 4
DC11-AE	Same as DC11-AA except 75, 110, 134.5, 150 Baud.	PDP-11	350	1 SU	0.0	3	50	Note 3 or 4

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Type Number	Description	Prerequisites	Price	Mounting Code See New Mounting Codes	Power Requirements See Note 6	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
DR11-B	General-purpose, direct-memory access interface to PDP-11. Moves data directly to or from user's device to memory at DMA speeds. Includes word count, current address, and data registers. Can also be used for high-speed processor-to-processor communication.	PDP-11	1,200	1 SU	3.2	12	75	Note 3 or 4
DD11-A	Peripheral Mounting Panel (includes UNIBUS Connector Module—M920). Prewired System Unit for 4 small peripheral controllers (one System Unit).	PDP-11	175	1 SU	0.0		50	Note 3 or 4
DB11-A	UNIBUS Repeater. Allows an additional 18 unit loads and an additional 50 feet of UNIBUS extension to be added to the PDP-11 system.	PDP-11 KH11-A	1,000	1 SU	2.2	5	75	Note 3 or 4
KH11-A	Large system capability option one required for each system having a Bus Switch or Bus repeater.	PDP-11	700		0.0	25*	300	Note 3 or 4
BB11	*Blank Mounting Panel—Wired for bus and power (Does not include UNIBUS connector Module—M920). For custom interface design and mounting System Units.*	None	90	1 SU	0.0			Note 5
M783	*UNIBUS Transmitter Module; UNIBUS to Device interface drivers, (12 drivers).*	None	30		0.0			Note 5
M784	*UNIBUS Receiver Module; UNIBUS to Device interface receivers, (16 receivers).*	None	30		0.0			Note 5
M785	*UNIBUS Transceiver Module; UNIBUS/Device interface drivers and receivers (8 receivers and 8 drivers).*	None	35		0.0			Note 5
M786	*General-Purpose Interface Module containing 16-bit Flip-Flop Register with bus receivers and transmitters.*	None	220		0.0			Note 5
M105	*Address Selector Module (4 Addresses).*	None	65		0.0			Note 5
M782	*Interrupt Control Module (2 interrupt capability).*	None	100		0.0			Note 5
M920	*UNIBUS Connector Module (Jumper module to interconnect System Units).*	None	45		0.0			Note 5
BC11A	*UNIBUS Cable*	None			0.0			
BC11A-2	*2'*		90					Note 5
BC11A-5	*5'*		100		0.0			Note 5
BC11A-8F	*8'6"*		105		0.0			Note 5
BC11A-10	*10'*		110		0.0			Note 5
BC11A-15	*15'*		125		0.0			Note 5
BC11A-25	*25'*		160		0.0			Note 5

ANALOG TO DIGITAL

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
AD01-D	Analog to Digital Conversion Subsystem. 10-bit unipolar or 10-bit plus sign (optional) analog to digital converter, multiplexer control for up to 32 channels of single-ended, high-level inputs; with interface and power supply. Program selectable input ranges of: 0 to +1.25V, +2.5V, +5.0 or +10.0V unipolar; 0 to ±1.25V, ±2.5V, ±10.0V bipolar.	PDP-11	2,400	PAN	0.0	20	150	Note 3 or 4

Options—mount in AD01-D

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
A124	Mux Module 4 channels.	AD01-D	60		0.0	2	20	Note 3 or 4
AH04	Sample & Hold.	AD01-D	300		0.0	3	50	Note 3 or 4
AH05	Sign Bit, 11th Bit, 2's complement.	AD01-D	400		0.0	6	80	Note 3 or 4

*If KH11-A is present, maintenance contract must cover both central processor and KH11-A.

Type Number	Description	Prerequisites	Price	Mounting Code See New Mounting Codes	Power Requirements See Note 6	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
DIGITAL TO ANALOG								
AA11-D	Digital to Analog Converter Subsystem. 11-bits plus sign digital to analog conversion with up to 4 channels available with an adjustable full-scale output voltage of 0 to ±10V at 10 ma. Space available for 4 BA614.	PDP-11	1,000	1 SU	2.9	6	10	Note 3 or 4
BA614	Digital to Analog Converter—mounts in AA11-D.	AA11-D	375		0.0	5	30	Note 3 or 4
CRT DISPLAYS AND TERMINALS								
AA11-A	Control for 611 scope. Space available for 2 more BA614; mounts in AA11-D.	AA11-D+ (2) BA614	600	1 SU	2.9	4	20	Note 3 or 4
VT01-A	Tektronix 611 Storage Tube Display.	AA11-D AA11-A +(2) BA614	3,000	FS	0.0	75	60	NO
AA11-B	Control for RM503 Scope. Space available for 2 more BA614; mounts in AA11-D.	AA11-D + (2) BA614	600	1 SU	2.9	4	20	Note 3 or 4
VR01A	Tektronix RM503 Oscilloscope Display Oscilloscope Display.	AA11-D+ AA11-B+ (2) BA614	1,000	PAN	0.0	14	90	NO
AA11-C	Control for VR14 Scope. Space available for 2 more BA614; mounts in AA11-D.	AA11-D (2) BA614	600	1 SU	2.9	4	20	Note 3 or 4
VR14	7″ x 9″ Point Plot Display.	AA11-D+ AA11-C+ (2) BA614	3,000	PAN	0.0	18	100	Note 3 or 4
VR14A	Same as above except 230V, 50/60Hz.	AA11-D+ AA11-C+ (2) BA614	3,000	PAN	0.0	18	100	Note 3 or 4
VT05-A	Alphanumeric CRT display with keyboard. Half- or full-duplex, 64/128 character set keyboard, 20 lines of 72 characters per line on screen size of 8¾″ x 6⅝″. Totally Teletype compatible at 110, 150, 03 300 Baud 115V, 60Hz.	PDP-11 KL11-A, B, C or DC11	2,795	FS	0.0	35	80	Note 3 or 4
VT05-D	Same as above; except 230V, 50Hz.				0.0			
COMMUNICATIONS								
ASYNCHRONOUS INTERFACES								
KL11-A	Full Duplex Asynchronous Line Interface Unit; 110 Baud.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-B	Same as KL11-A except 150 Baud.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-C	Same as KL11-B, except 300 Baud.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-D	Same as KL11-B, except 600 Baud.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-E	Same as KL11-B, except 1200 Baud send, 110 Baud receive.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
KL11-F	Same as KL11-A, except 2400 Baud.	PDP-11	400	SPC	1.5	6	60	Note 3 or 4
DE11-A	Line adaptor for EIA Level signal conversion send/receive only for connection to terminal devices.	KL11 Series	100		0.0	2	20	Note 3 or 4
DC11-AA	Dual Asynchronous Serial Line System Unit and Clock for mounting 2 DC11DA Module Sets. 110, 134.5, 150, 300 Baud (typical speeds with 103 modem, program selectable).	PDP-11	250	1 SU	0.0	3	50	Note 3 or 4
DC11-AB	Same as DC11-AA except 110, 300, 1200 and 1800 Baud (typical 202 speeds, program selectable).	PDP-11	250	1 SU	0.0	3	50	Note 3 or 4
DC11-AC	Same as DC11-AA except 110, 150, 600 and 1200 Baud (typical European, program selectable).	PDP-11	250	1 SU	0.0	3	50	Note 3 or 4
DC11-AD	Same as DC11-AA except 50, 110, 134.5, 150 Baud.	PDP-11	350	1 SU	0.0	3	50	Note 3 or 4
DC11-AE	Same as DC11-AA except 75, 110, 134.5, 150 Baud.	PDP-11	350	1 SU	0.0	3	50	Note 3 or 4

Type Number	Description	Prerequisites	Price	Mounting Code See New Mounting Codes	Power Requirements See Note 6	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
DC11-AG	Same as DC11-AA except 134.5, 150, 300, 1200 Baud.	PDP-11	250	1 SU	0.0	3	50	Note 3 or 4
DC11-AH	Same as DC11-AA except 110, 134.5, 600, 1200 Baud.	PDP-11	250	1 SU	0.0	3	50	Note 3 or 4
DC11-AX	Same as DC11-AA except 110, 134.5, 150 Baud plus one non-standard Baud rate above 600 Baud.	PDP-11	350	1 SU	0.0	3	50	Note 3 or 4
DC11-DA	Full Duplex Serial Module Set for DC11-A (DC11-A accommodates 2 ea.) with EIA/CCITT termination suitable for direct use with 103 or 202 modems. Handles 5, 6, 7 or 8 bit codes with 1 or 2 stop bits.	Any DC11-A	600		2.0	7	50	Note 3 or 4
H312A	*Asynchronous Null Modem—allows direct connection of any peripheral having an EIA 232 interface. Mounts DC11-DA, DP11-DA or DM11-DB. Note: DP11-KA required when used with DP11-DA.*		60		0.0	2	50	Note 5
DM11-AA	Asynchronous 16-Line Single Speed Multiplexer and Mounting Panel. Includes space for mounting up to 4 line adapters (16 line interfaces). Order must specify the Baud rate (up to 1200 Baud for 16 lines). If no speed is specified, 110 Baud will be supplied. (115V).	PDP-11	3,200	2 SU PAN	4.9	30	175	Note 3 or 4
DM11-AB	Same as DM11-AA less Distribution Panel; for use with DC08-CS Telegraph Line Interface option.	PDP-11	2,900	2 SU	4.9	30	175	Note 3 or 4
DM11-AC	Same as DM11AA, for 230V, 50Hz.	PDP-11	3,200		0.0			Note 3 or 4
DM11-DA	Line adapter which implements four Teletype lines (data only).	DM11-AA, AC	150	Sm. Pan.	0.0	5	40	Note 3 or 4
DM11-DB	Line adapter which implements four EIA lines (data only). Includes four 25′ modem cables.	DM11-AA, AC	450	Sm. Pan.	0.0	10	40	Note 3 or 4
DM11-BB	Modem Control Multiplexer; provides control leads to interface with Bell 103 & 202 modems or equivalents.	DM11-AA, AC	1,200		0.0	18	80	Note 3 or 4
DM11-DC	Provides line conditioning for 4 EIA RS-232-C compatible lines with modem control, plus 4 25′ modem cables. Mounts in DM11AA, AC.	DM11AA, AC	800		0.0	5	40	Note 3 or 4

SYNCHRONOUS INTERFACES

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
DP11-DA	Full/Half Duplex Synchronous Line Module Set and System Unit. Double buffered. EIA/CCITT termination suitable for direct use with 201 modems. Includes 25′ modem cable. Space available for one DP11-CA or DP11-KA.	PDP-11	1,400	1 SU	2.5	18	125	Note 3 or 4
DP11-CA	Data/Sync Register Extender. Adds the ability to handle 10-, 11-, and 12-bit data characters. Mounts in DP11.	DP11-DA or DP11-DC	300		0.0	3	50	Note 3 or 4
DP11-KA	Internal Clock. Clocking source to be used for direct connection of DP11 to local synchronous terminal or a local synchronous computer interface (without modems). For following Baud rates: 2400, 4800, 9600, 19.2K and 40.8K. Baud rate must be specified. Mounts in DP11.	DP11-DA	200		0.0	3	50	Note 3 or 4

AUTO DIAL INTERFACES

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
DN11-AA	Prewired system unit and control for four Bell 801 Automatic Calling Unit Interfaces Type DN11-DA.	PDP-11	300	1 SU	0.0	5	70	Note 3 or 4
DN11-DA	Module set for the DN11-AA, Interfaces directly with Bell 801 ACU. Includes 25′ cable (up to 4 DN11-DA's can be mounted in each DN11-AA).	DN11-AA	400		1.0	3	50	Note 3 or 4

TELEGRAPH LINE INTERFACES

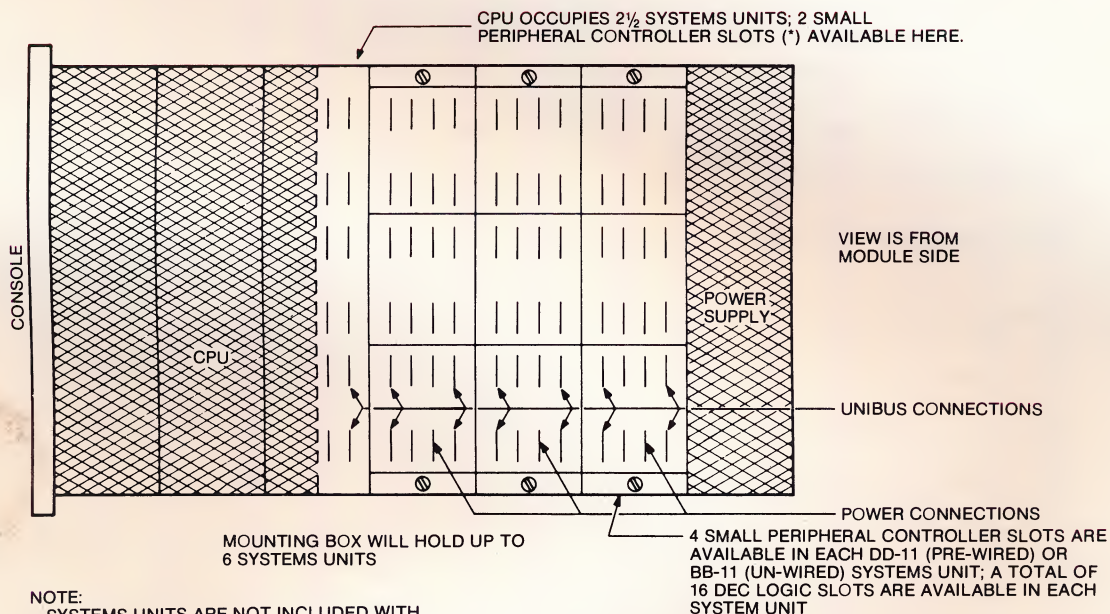| Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
DC08-CS	Telegraph Line Interface Panel. Accommodates up to 16 DC08-CM Dual-Line Adapters. Consists of wired system unit, rack, and control modules.	PDP-11 DM11-AB	2,000	CAB	0.0	4	25	Note 3 or 4

Type Number	Description	Prerequisites	Price	Mounting Code See New Mounting Codes	Power Requirements See Note 6	Monthly Maintenance Contract Rates 1 Shift	Field Installation Rates	Discount Status
DC08-CM	One Dual Telegraph Terminal and Receive Line Adapter. Implements 2 transmit and receive telegraph line interfaces in the DC08-CS.	PDP-11 DC08-CS	215		0.0	2	25	Note 3 or 4
H793	Power Supply to provide power to the transmit side of telegraph line. H793; 150V, 60Hz. H793-A; 230V, 50Hz.		500		0.0	7	50	Note 3 or 4
DC08-EB	Telegraph Line Current Adjustment Panel. Provides line current monitoring and adjustment for 32 telegraph receive and transmit lines.	PDP-11 DC08-CS	2,000		0.0	2	120	Note 3 or 4
893	Fuse Panel; provides individual line fuse for each of 32 telegraph lines (receive and transmit).	PDP-11 H793	1,000		0.0	0	30	Note 3 or 4
DC08-D	Distribution Panel provides individual terminal blocks to facilitate connection of 32 telegraph lines.	PDP-11 DC08-CS	1,000		0.0	2	120	Note 3 or 4

MOUNTING BOXES AND POWER SUPPLIES

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
BA11-EC	Extension Mounting Box with **Table Top Cover.** Includes a fan and BC11A-8F UNIBUS Cable.	None	450	FS	0.0	0	60	Note 3 or 4
BA11-ES	Extension Mounting Box with **Tilt and Lock Chassis Slides.** Includes fans and BC11A-8F UNIBUS Cable.	None	400	PAN	0.0	0	60	Note 3 or 4
H720-E	Power Supply 115V 50/60Hz—22A @ +5V	None	600		0.0	10	50	Note 3 or 4
H720-F	Power Supply 230V 50/60Hz—22A @ +5V	None	600		0.0	10	50	Note 3 or 4
H960-CA	Free Standing Base Cabinet. Includes fans, power distribution panel, extension feet, front bezel panels.	None	650	CAB	0.0			Note 3 or 4
H952-HA	Free Standing Table with adjustable height legs for use with H960-CA cabinet.	None	120	FS	0.0			Note 3 or 4
H961-A	Free Standing Cabinet without end panels.	None	430	CAB	0.0			Note 3 or 4

MAINTENANCE AND SPARE PARTS

Type Number	Description	Prerequisites	Price	Mounting Code	Power Requirements	Monthly Maintenance	Field Installation	Discount Status
KM11A	Maintenance Module—light and switch card for examination of machine states.	None	250					Note 3 or 4
5509081–0–1	Transparent overlay to KM11 to check out the KE11-A Extended Arithmetic Element.							
5509181–0–3	Same as above, for RK11.							
5509181–0–5	Same as above, for TM11/TU10 Mag Tape Unit. Price: $5.00 each							
SP11-KA	KA11 Processor Spare Parts	PDP-11/20 KA11	2,950					Note 3 or 4
SP11-KB	Spare Parts for KA11 Processor with KH11 Option	PDP-11/20 (KA11 with KH11 Option)	2,950					Note 3 or 4
SP11-MA	Spare parts for the MM11-E Memory	PDP-11 MM11-E	700					Note 3 or 4
SP11-MB	Spare parts for the MM11-F Memory	PDP-11 MM11-F	700					Note 3 or 4
SP11-PA	Spare parts for the H720-A and H720-B Power Supplies	PDP-11 H720-A, B	195					Note 3 or 4
SP11-PB	Spare parts for the H720-E and H720-F Power Supplies	PDP-11 H720-E, F	195					Note 3 or 4

MOUNTING CODES

PAN	Panel Mounted (10½″)
SM PAN	Small Panel Mounted (5½″)
CAB	Cabinet Mounted, Cabinet Included
FS	Free Standing Unit
MOD	Module
1 SU	One System Unit
2 SU	Two System Units
SPC	Small Peripheral Controller
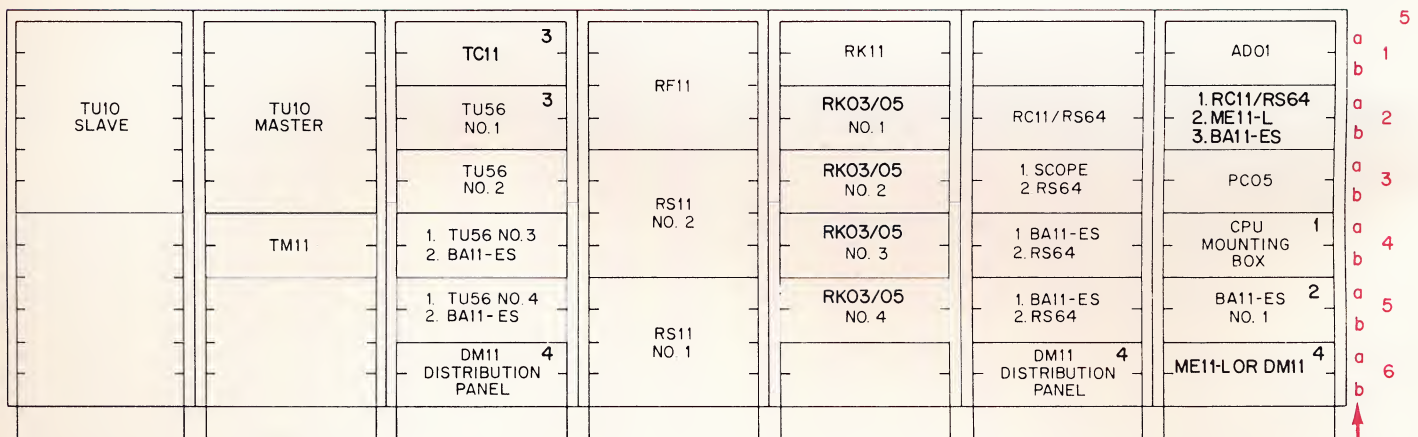
1. PROCESSOR, MEMORY, EAE, DD11, KW11-L
2. DD11, DR11, BB11, MEMORY, SMALL PERIPHERAL CONTROLS, COMMUNICATIONS
3. CABINET INCLUDED WHEN TC11/TU56 IS PURCHASED
4. THE DM11 DISTRIBUTION PANEL SHOULD BE BELOW THE BA11 CONTAINING THE DM11
5. MOUNTING POSITIONS FOR ME11-L IN ORDER OF TECHNICAL PREFERENCE: 5a, 2a, 6a, or 1b. IN NON-PROCESSOR CABINETS ME11-L CAN BE MOUNTED IN ANY LOCATION ACCEPTABLE FOR A BA11-ES.

CPU OCCUPIES 2½ SYSTEMS UNITS; 2 SMALL PERIPHERAL CONTROLLER SLOTS (*) AVAILABLE HERE.

VIEW IS FROM MODULE SIDE

UNIBUS CONNECTIONS

POWER CONNECTIONS

MOUNTING BOX WILL HOLD UP TO 6 SYSTEMS UNITS

4 SMALL PERIPHERAL CONTROLLER SLOTS ARE AVAILABLE IN EACH DD-11 (PRE-WIRED) OR BB-11 (UN-WIRED) SYSTEMS UNIT; A TOTAL OF 16 DEC LOGIC SLOTS ARE AVAILABLE IN EACH SYSTEM UNIT

NOTE:
SYSTEMS UNITS ARE NOT INCLUDED WITH MOUNTING BOX

ONE SYSTEM UNIT IS INCLUDED WITH EACH MEMORY ORDERED (EXCEPT M792)

* THESE SMALL PERIPHERAL CONTROLLERS MAY BE:
1. TTY CONTROLLER (KL-11)
2. HIGH-SPEED READER/PUNCH CONTROL
3. LINE-PRINTER CONTROL
4. CARD READER CONTROL
5. 32-WORD DIODE ROM BOOTSTRAP
6. DR-11A GENERAL PURPOSE INTERFACE
7. LA30 CONTROLLER—LC11
8. ALL KL11 SERIES CONTROLLERS

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When ordering PDP-11 systems it is important that sufficient mounting hardware is ordered to accommodate each system. Particular attention should be given to the number of DD11's required and whether a BA11-EC or BA11-ES Extension Mounting Box is needed.

DD11's are System Units prewired to mount small peripheral controllers such as a Teletype control or a High Speed Paper Tape Reader/Punch control. Each DD11 can hold four controllers and mounts in $\frac{1}{6}$ of a Basic or Extension Mounting Box. This is in addition to the two small peripheral controller slots available in the KA-11.

To determine the number of DD11's to order, total the number of spaces required for each item ordered times the quantity ordered. Subtract one from this number and divide by four. Round up to the next whole number if there is a remainder. Order this number of DD11's. (Remember, a console teleprinter is included in all normal PDP-11 configurations.).

$$\frac{\# \text{ of "Spaces" used} - 1}{4} = \# \text{ of DD11's needed.} \quad \text{Note: Round up to a whole number}$$

Six System Units will mount in either the Basic or the Extension Mounting Box. To determine whether to order an Extension Mounting Box, total the products of the number of System Units required for each item ordered times the quantity ordered. Include DD11's and BB11's. Add one and divide the new total by six and round up to the next whole number if there is a remainder. If the result is one, an Extension Mounting Box is not needed. If the result is two, order an Extension Mounting Box (BA11-ES or BA11-EC) and Power Supply (H720A or H720B).

$$\frac{\# \text{ of System Units used}}{6} = \# \text{ of Mounting Boxes Required}$$

Note: Round up to a whole number. If the result is greater than one an Extension Mounting Box is needed.

Note 2
    Discountable under PDP-11 OEM discount agreement CODE A/Type I.

Note 3
    Discountable under PDP-11 OEM discount agreement CODE B/Type II.

Note 4
    Discountable under PDP-11 quantity discount agreement.

Note 5
    Available from Module Sales; subject to Module Sales discount agreement, these items appear in italics.

Note 6
    This column lists current in amps drawn from a +5 VDC power supply. It applies to units that mount in a BA11 mounting box using H720 power supplies which are rated at 22 amps. Power requirements for items having their own power supply and items that do not require power show "0".

NOTES

NOTES

SOFTWARE POLICIES AND PRICES

Currently available software for the PDP-11 is listed below. Most of the software is available at no charge to purchasers of supporting hardware. All software except the standard PDP-11/20 paper-tape software and single user *Basic,* which are automatically shipped with all PDP-11/20 end-user configuration *must* be included in purchase orders even if it is a no-charge item. The software packages available at a charge are non-discountable and are not included in the listed system hardware prices.

Ordering Designation	Description	Prerequisite	Price with Requisite Hardware
LIBKIT-11-DOSD LIBKIT-11-DOSP	Disk-Operating System software. Available in two versions: LIBKIT-11-DOSD (on DECtape) and LIBKIT-11-DOSP (on paper tape). Consists of the following modules: 1. Monitor 2. Relocatable Assembler 3. Editor 4. Linker 5. ODT, On-Line Debugger 6. PIP, Peripheral Interchange Package 7. FORTRAN Compiler 8. One week customer training	See Preceeding Page	N/C N/C
LIBKIT-11-RSTS	Software package for the RSTS-11 Resource Timesharing System consisting of: 1. DECtape Binary of RSTS 2. User Manuals and System Manager's Guide 3. One week customer training	See Preceeding Page	N/C
LIBKIT-11-RS XCA	RSX-11C Real-Time Executive. Provides multi-task scheduling, input/output operator communication and other functions required for real-time multi-programmed operations. The package includes: 1. FORTRAN (core only) Run-Time System 2. One week of training 3. Listings and Sources 4. One week field Software Support	PDP-11/20 with 12K	2,500

digital

1972

DIGITAL EQUIPMENT CORPORATION

pdp 11/45 oem

Effective July 1, 1972

PRICE LIST

TYPE NUMBER	DESCRIPTION	PREREQUISITE	PRICE	SYSTEM UNITS MODULE MOUNTING	SPACE REQUIRED (¼ SYSTEM UNITS)	UNIBUS LOAD	MTHLY. MAINTENANCE CONTRACT RATES 1 SHIFT	FIELD INSTALLATION RATE/ON-SITE EXPN.	DISCOUNT STATUS
CENTRAL PROCESSORS									
PDP-11/45DA	PDP-11/45 computer consisting of: 1. KB11 Central Processor 2. MM11-S Core Memory, 8K words 3. Power Supply 4. Programmer's Console 5. Asynchronous Interface Unit for console terminal 6. Cabinet with Extension Mounting Box 7. Power Fail/Restart 8. Installation 9. 30 day on-site warranty 10. One set of Circuit Schematics 11. Operates on 115V, 60Hz	none	$17,500	CPU	0	1	120	–	Type 2
PDP-11/45DB	Same as PDP-11/45DA, but operates at 230V, 50Hz	none	17,500	CPU	0	1	120	–	Type 2
PDP-11/45DC	Same as PDP-11/45DA plus LA30 DECwriter for console terminal; hard copy output at 30 cps; keyboard input Operates at 115V, 60Hz	none	19,500	CPU	1	2	150	–	Type 2
PDP-11/45DD	Same as PDP-11/45DB plus LA30 DECwriter for console terminal; hardcopy output at 30 cps; keyboard input Operates at 230V, 50Hz	none	19,500	CPU	1	2	150	–	Type 2
PDP-11/45DE	Same as PDP-11/45DA plus VT05 DEC Alphanumeric CRT for console terminal. Includes keyboard and transfers at 30 cps Operates at 115V, 60 Hz	none	19,500	CPU	1	2	142	–	Type 2
PDP-11/45DF	Same as PDP-11/45DB plus VT05 DEC Alphanumeric CRT for Console Terminal. Includes keyboard and transfers at 30 cps Operates at 230V, 50Hz	none	19,500	CPU	1	2	142	–	Type 2
MEMORY MANAGEMENT									
KT11-C	Memory Management Unit - implements memory protection and relocation Required on all systems with more than 28K of main memory	11/45	3,900.	CPU	—	0	30	50	Type 2
FLOATING POINT PROCESSOR									
FP11-B	Floating Point Processor. Performs hardware operations on 32 and 64 bit floating point numbers as well as integer to floating conversions.	11/45	4,900.	CPU	—	0	42	100	Type 2

TYPE NUMBER / DESCRIPTION	PREREQUISITES	PRICE	SYSTEM UNITS MODULE MOUNTING	SPACE REQUIRED (¼ SYSTEM UNITS)	UNIBUS LOAD	MTHLY. MAINTENANCE CONTRACT RATES 1 SHIFT	FIELD INSTALLATION RATE/ON-SITE EXPN.	DISCOUNT STATUS
MEMORY CONTROLLERS								
MS11-CC Bipolar Memory Control. Controls up to four (4) MS11-CM or MS11-CP Bipolar Memories.	11/45	1,950	CPU		1	12	25	Code B
MS11-BC First MOS Memory Control. Controls up to four (4) MS11-BM or MS11-BP MOS memories.	11/45	1,950	CPU		1	12	25	Code B
MS11-BD Second MOS Memory Control. Controls up to four (4) additional MS11-BM or MS11-BP memories.	11/45 MS11-BC	1,500.	CPU		1	12	25	Code B
Note: A system may have a maximum of two (2) solid state memory controllers.								
MEMORIES								
MS11-CM 1K Bipolar memory. 1024 words. 300 nanosecond cycle time.	MS11-CC	1,950	CPU		0	15	26	Code B
MS11-CP 1K Bipolar memory with byte parity. 1024 words. 300 nanosecond cycle time.	MS11-CC	2,500.	CPU		0	19	28	Code B
MS11-BM 4K MOS Memory. 4096 words. 450 nanosecond cycle time.	MS11-BC	4,500.	CPU		0	40	26	Code B
MS11-BP 4K MOS Memory with byte parity, 4096 words. 450 nanosecond cycle time.	MS11-BC	5,200.	CPU		0	44	28	Code B
MM11-SP 8K Core Memory with Parity and Controller. 8192 words. 900 nanosecond cycle time. Cannot be plugged into 11/20 (BA11-ES) Expander Box.	11/45	5,700	1	0	1	40	130	Code A
MM11-S 8K Core Memory and Controller. 8192 words. 900 nanosecond cycle time. Cannot be plugged into 11/20 (BA11-ES) Expander Box.	11/45	4,700.	1	0	1	36	125	Code A
DIODE MEMORIES								
BM792-YA Paper-tape (TTY or a high speed reader) Bootstrap Loader	11 Family	300	0	1	1	3	50	Code B
BM792-YB Bulk Bootstrap Loader		300	0	1	1	3	50	Code B
BM792-YC Card-reader Bootstrap Loader		300	0	1	1	3	50	Code B
MR11-DB 64 word Bulk Storage Bootstrap Loader	11/45	500	0	2	2	35	75	Code B
CLOCKS								
KW11-L Line Frequency Clock. When enabled, interrupts every 16.67 milliseconds.(20 ms on 50 Hz) Mounts in a dedicated cpu slot.	11 Family	250	CPU		1	3	50	Code B
KW11-P Programmable Real Time Clock. Program selectable interrupt rates of 100K Hz, 10K Hz, or line frequency.	11 Family	600	0	1	1	3	50	Code B

DEC serves the OEM by providing quality products at a minimal price. However, since
OEM's develop products for a wide range of applications with varying system require-
ments, DEC offers the following services on a "when needed" basis. These services
are listed separately so that the lowest price can be offered to the OEM who does
not require them. Consequently, each customer can select the specific services
desired and is not forced to pay for services that are not desired.

SOFTWARE

DISK OPERATING SYSTEM

The PDP-11 Disk Monitor is a disk-resident software system which enables a
PDP-11 user to efficiently develop and execute his programs. During program
development, the monitor serves the user by providing a simple, easy-to-use
interface with program development software such as the relocating assembler,
FORTRAN compiler, editor, etc. During program execution, the monitor eases the
burden on the user program by providing common I/O device handling routines,
loaders, operator interface, and basic resources accounting. The Disk Operating
System offers modular design for extreme flexibility, random access and sequen-
tial files, file protection, simultaneous I/O with processing and user access to
a complete set of Monitor subsystems.

TYPE NO.	DESCRIPTION	PRICE
LIBKIT-11-DXXD	Disk Operating System consisting of manuals and the following binary modules on DECtape	$3,000 N/C with Minimum DOS Con- figuration*
	1. Monitor	
	2. Relocatable Assembler	
	3. Editor	
	4. Linker	
	5. On-line Debugger, ODT	
	6. Peripheral Interchange Package	
	7. FORTRAN Compiler	
LIBKIT-11-DSLS	Source listing of items 1 through 6	153.
DEC-11-KFFA-PA	Source listing of compiler, run-time package and library with source code on a load device of either DECtape or paper tape.	1,000.

*Minimum PDP-11/45 DOS configuration:
1. CPU with 16K memory
2. Disk (RS11 or RK05)
3. DECtape

4. Real-Time Clock
5. Bootstrap Loader
6. Console Terminal

RSX-11D REAL-TIME SYSTEM EXECUTIVE

A real-time operating system which schedules multiple tasks on a true priority
basis. All tasks are executed under hardware memory protection to assure
maximum system security from undebugged programs. I/O handlers are provided for
system peripherals including process I/O controllers, UDC, AFC, and AD01. Run
time operator communication is provided with a keyboard I/O package. A FORTRAN
Run Time System is also included which permits execution of programs written in
standard ANSI FORTRAN IV with extensions to implement the industry accepted
CALL's for process I/O.

Background (low priority) tasks such as on-line FORTRAN compile, assemble, debug, and batch program executions are also provided in RSX-11D.

TYPE NO.	DESCRIPTION	PRICE
LIBKIT-11RSXDA	RSX-11D consisting of:	$5,000.

1. Source Load Deck
2. Source Listing
3. Manuals
4. One-week Training Course at DEC
5. Five Days On-Site Software Support

COMTEX-11

The COMTEX-11 data communications software system provides handlers for DEC-supplied communication line controllers and terminals. COMTEX-11, a modular system, is easily adapted to special terminal and line requirements of the user. COMTEX-11 is a significant part of any software system for message switching, remote batch, concentrators, front ends, etc.

TYPE NO.	DESCRIPTION	PRICE
QJ21-DA	Communications software system for COMTEX-11 consisting of the following:	$2,500.

1. SCIP System Control and Interface Program Module
2. ISR Interrupt Service Routine for the 16 Terminal DC11 Asynchronous Line Interface
3. TAP Terminal Application Module for Teletypes (ASR33, 35 & 37)
4. 16 Terminal Test Program
5. One Day of On-Site Training
6. Source Tapes, Listing, Flow Charts, Manuals

QJ20-DA	SCIP System Control and Interface Program software module only. For use with any PDP-11 communication system where user will write his own ISR and TAP	$1,400.

All software prices are non-discountable.

Software may be reproduced by the OEM under a separate licensing agreement.

TRAINING

Any 1 week regularly scheduled DEC Course	$300.
Any 2 week regularly scheduled DEC Course	$500.

Regularly scheduled courses are taught for both hardware and software. These are available to either the OEM or the end user.

INSTALLATION

On-site installation at the OEM's facility is provided for all PDP-11/45's.

WARRANTY

A 30-day, on-site warranty is provided. This is a warranty for both parts and labor.

MAINTENANCE

Hardware maintenance is available on a yearly contract basis or as an on-call service. The maintenance rates listed in this price list are for a contract covering scheduled preventative maintenance plus emergency calls during the normal 40-hour business week. Additional emergency coverage is available at an increased rate.

On-call service is provided on a per diem basis for time, materials and travel expenses.

DIAGNOSTICS

One set of hardware diagnostics and write-ups is furnished with the first PDP-11/45 delivered under an OEM contract. Additional sets may be reproduced by the OEM or provided by DEC for a nominal reproduction fee.

Hardware diagnostics are available on paper tape, DECtape, TU10 Industry Compatible Magnetic Tape or RK05 Disk Cartridge. All PDP-11/45 systems must have one of these devices in order to load the diagnostics.

MANUALS

One complete set of hardware maintenance manuals is provided with the first PDP-11/45 delivered. Additional sets may be purchased from DEC or reproduced by the OEM under a separate licensing agreement with DEC.

SPARE PARTS KITS

Several Spare Parts Kits are provided for the customer who requires minimum down time or for those performing their own maintenance. Complete circuit boards are available in some kits for simple, plug-in replacement of a faulty board. A full set of circuit boards also aids in troubleshooting and isolating a hardware malfunction. Individual electrical components are available in Spare Parts Kit (SP11-KF). This kit is for the customer planning to do his own board repair.

TYPE NO.	DESCRIPTION	PRICE	DISCOUNT STATUS
SP45-KA	Maintenance Tool Kit - includes tools, maintenance aids and back panel wire-list.	$1,000.	Code B
SP45-KB	Processor Modules - includes the eight circuit boards which comprise the basic processor (M8100 thru M8106 and M8109).	7,900	Code B
SP45-KC	Console Module - the large console driver board for the programmer's console.	700	Code B
SP45-MA	MOS Memory Modules - contains one MOS Memory Control Board (MS11-BC) and one MOS Memory Matrix Board (MS11-BM).	6,300	Code B
SP45-MB	Bipolar Memory Modules - contains one Bipolar Memory Control Board (MS11-CC) and one Bipolar Memory Matrix Board (MS11-CM)	3,700	Code B

SP45-KD	Memory Management Modules - includes the two circuit boards which contain the Memory Management Unit (M107 and M108).	3,500	Code B
SP45-KE	Floating Point Processor Module - includes the four circuit boards which contain the Floating Point Processor (M112 thru M115).	4,500	Code B
SP45-PC	Major Power Supply subassembly spares - contains one each of the three types of modular, plug-in power regulators (H744, H745 and H746).	1,000	Code B
SP11-KF	PDP-11/45 Systems Parts Spares - contains set of electrical components for board repair. Type of component and quantity included is based on utilization in the system modules.	2,900	Code B
SP11-MD	Core Memory Component Parts Spares	700	Code B

All prices quoted are FOB DEC's plant and apply in the continental United States only. Federal, State and local taxes are not included. All prices and specifications are subject to change without notice.

NOTES:

	Industry Compatible Magnetic Tape								DEC tape	Extension	
TU10 7 9 track	TU10 7 9 track	TU10 7 9 track	TU10 7 9 track	TU10 7 9 track	TU10 7 9 track	TU10 7 9 track	TU10 7 9 track TM11*	TC11* TU56 TU56 TU56 TU56 TU56-H			
19	18	17	16	15	14	13	12	11	10	9

* Imposes one (1) UNIBUS load
** Imposes two (2) UNIBUS loads

If both 7 and 9 track are included, master (cabinet 12) must be 9 track.

Circle H961-A (cabinet 10)   Circle H961-A (cabinet 9)

SMALL PERIPHERAL CONTROLS

PR11	1/4*	mounts on DD11-A
PC11	1/4*	mounts on DD11-A
CR11	1/4*	mounts on DD11-A
LP11	1/4*	mounts on DD11-A

MEMORIES

MM11-S	1*	cannot mount in BA11-ES
MR11-DB	1/2**	mounts on DD11-A

DISPLAY CONTROLS + A/D

AA11-D	1*	
BA614	(1/4)	
AA11-A	(1/2)*	Limit of one
AA11-B	(1/2)*	display control
AA11-C	(1/2)*	on AA11-D

PROGRAMMABLE CLOCK

KW11-P	1/4*	mounts on DD11-A

COMMUNICATIONS

KL11-	1/4 *	mounts on DD11-A
DE11-A	(1/4)	
LC11-A	1/4 *	mounts on DD11-A
DC11-A	1	
DC11-DA	(1/2)*	
DM11-AA	2 *	
DM11-D	(1/2)	
DP11-D	1 *	
DP11-CA	(1)	
DP11-KA	(1)	
DN11-AA	1	
DN11-DA	(1/4)*	

INTERFACE EQUIPMENT

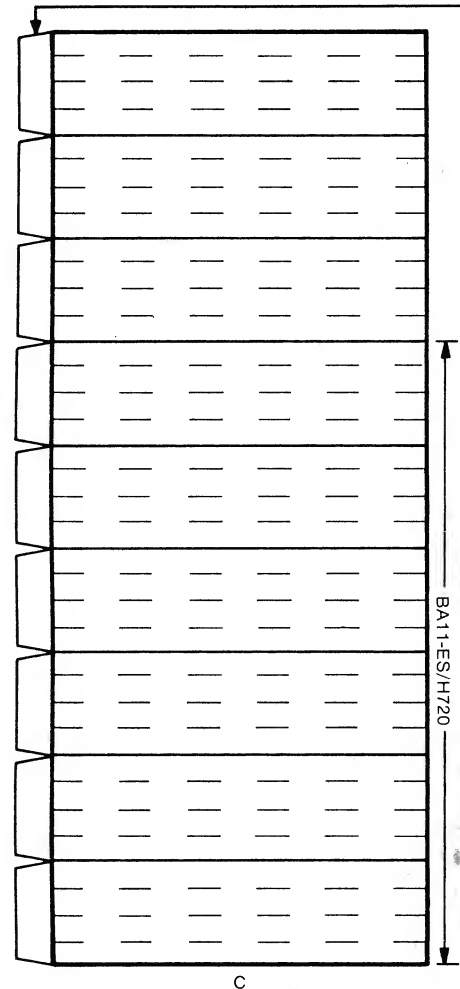|	
DR11-A	1/4 mounts on DD11-A
DR11-B	1
BB11	1
A/D Equipment	
AD01-D	

CABINET

H961-A

If the size is enclosed in parentheses, the option mounts on the **same** System Unit as the option listed above it.

UNIBUS LOAD TALLY

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20   DB11-A 1
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38   DB11-A 1

BA11-ES/H720

C

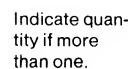
CONFIGURING RACK-MOUNTED and FREE-STANDING OPTIONS

Start in the upper right-hand corner and work across to the left, circling the options to be included. Comments below a cabinet refer to the options in that cabinet. Do not circle extension mounting boxes at this time. Special options should be written into cabinets 9 and 10, then circled. (It may be necessary to rearrange options in cabinets 7-10 after the number of mounting boxes has been calculated.)

CONFIGURING CPU-MOUNTED OPTIONS

In the shaded part of diagram A, circle all cpu options to be included. Circle the word PARITY if the memories are to be so equipped.

CONFIGURING SYSTEM UNIT MOUNTED OPTIONS

Go to the left side of the worksheet and circle all internal options to be included. If more than one is to be included, write the number to the left. Note that some options, such as the tape reader controls and scope controls, may already have been circled while configuring rack-mounted options. Next, write each option into a system unit space in one of the mounting box diagrams. Work from the bottom up, filling diagram A first, then B, and finally C The number beside each option indicates how much space it takes (one-quarter system unit, one-half, a full unit or, in the case of the DM11-AA, two full units). If the option being written in mounts on a DD11-A, write

H960-E	DM11-AA	RS11	RS11	RF11*		RK11*	AD01-D*		VT05
	RC11/RS64 VR14				RK02 RK03	RK02 RK03	A124 AH04 AH05		
	RS64	RS11	RS11	RS11			VT01-A VR01-A BA11-ES	CR11	LA30
	DM11-AA				RK02 RK03	RK02 RK03	PR11 PC11		
		RS11	RS11	RS11	RK02 RK03	RK02 RK03		LP11 80 132 Columns 64 96 Characters	LT-33
	H960-D				RK02 RK03	RK02 RK03	11/45*		LT-35
8	7	6	5	4	3	2	1		

DM11-AA also has an internal component.

Circle controllers for VT01, VR01, VR14, PR11, PC11, CR11, LP11.

Indicate quantity if more than one.

Enter DD11-A's where required.

LP11, CR11, PR11, PC11, and all scope controls must go in CPU box.

Console Terminal Controller*

Solid State Memory		
4096 WORDS	MS11-B MS11-B MS11-B MS11-B PARITY	MS11-C MS11-C MS11-C MS11-C 1024 WORDS
	MS11-BD* Controller MS11-CC*	
MOS	MS11-B MS11-B MS11-B MS11-B PARITY	MS11-C MS11-C MS11-C MS11-C BI POLAR
	MS11-BC* Controller MS11-CC*	

FP11-B   Floating Point

KT11-C   Segmentation

KW11-L*

CENTRAL PROCESSOR

* Imposes one (1) UNIBUS load

B   A

DD11-A beside that System Unit. *Note:* If the size of the option is in parentheses, this means it mounts *in the same system unit space* as the unparenthesized option above it. Write it into the same space on the diagram.

CONFIGURING UNIBUS REPEATERS

All options which impose a UNIBUS load are marked by an asterisk(*). Options that impose two loads are marked by two asterisks (**). The box in the lower left-hand corner should be used to tally UNIBUS loads. Each time an asterisked option is circled, cross off another number in the UNIBUS tally. If the total UNIBUS load is 20 or less, no DB11-A repeater is needed. However, if the count reaches 19 and is not yet complete, cross off 20 in the top row, circle the DB11-A, write it into the diagram (the 1 beside it indicates that a full System Unit is required) and continue the tally on the lower row. *Note:* The load tally should be kept as the options are being circled rather than as a separate step.

CONFIGURING EXTENSION MOUNTING HARDWARE

If, after all options have been written in, only diagram A has been filled, no extension boxes are needed. If only A and B are filled, circle the extension box in cabinet 7. If A, B, and C are full, circle the box in cabinet 8. Then complete the configuration by packing any additional options into cabinets 7, 9, and 10 so as to minimize the number of cabinets.

MAIN OFFICE AND PLANT

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Telephone: (617)-891-1030   TWX: 710-324-6919
CAMBRIDGE/BOSTON
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Telephone: (617)-491-6130   TWX: 710-320-1167
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Telephone: (203)-237-8441/7466   TWX: 710-461-0054

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TWX: 710-991-9721
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1259 Route 46, Parsippany, New Jersey 07054
Telephone: (201)-335-3300   TWX: 710-987-8319
PRINCETON
U.S. Route 1
Princeton, New Jersey 08540
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DIGITAL EQUIPMENT CORPORATION

all pdp-computers

OPTION BULLETIN

VT05 ALPHANUMERIC DISPLAY TERMINAL

digital

VT05 ALPHANUMERIC TERMINAL

- Completely interchangeable with Teletype (20 mil current loop)
- EIA RS-232C compatible communications interface
- Totally self-contained
- Direct cursor addressing
- Concurrent video-alphanumeric imaging
- Easy-to-read characters
- Solid-state circuitry
- Comprehensive (64/128 character set) keyboard

The VT05 is a flexible, high-performance alphanumeric display terminal with a video cathode ray tube display and communications equipment. It is capable of transmitting data over standard phone lines and data sets in half or full duplex modes at rates up to 300 Baud. For remote users, the VT05 serves as a non-mechanical terminal that handles data speeds many times faster than that of conventional teletypewriters. If desired, the alphanumerics can be superimposed on a background video image derived from a closed circuit TV camera or video tape player.

The VT05 is designed for use with all Digital Equipment Corporation computers: the PDP-8 Family, PDP-9, PDP-10, PDP-11, PDP-12 and PDP-15.

SPECIFICATIONS

DISPLAY

    Screen Size - 10-1/8" x 7-5/8"
    Character Display Area - 8-3/4" x 6-5/8"
    Characters/Line - 72
    Number of Lines - 20
    Number of Characters Displayable - 1440
    Contrast Ratio - 12:1
    Type of Phosphor - P4 (white)
    Deflection Type - Magnetic
    Deflection Method - Raster Scan
    Character Generation Method - 5 x 7 dot matrix

```
Character Generator - Read Only Memory (ROM)
Refresh Buffer - MOS Memory
Memory Size:
    ROM - 2240 bits
    Refresh Buffer - 9816 bits
Display Refresh Rate - 60 times/sec or 50 times/sec
    synchronized to power line frequency
Character Set - Upper case ASCII
Character Size - .23" x .11"
Cursor - Non-destructive, blinking (underline)
```

VIDEO

    Standard EIA-compatible signal

KEYBOARD/CONTROL

```
Type - Electronic (wafer switch)
    Standard model Teletype layout
Character Set - Selectable (upper case, standard
    ASCII; upper/lower case, full ASCII)
Controls:
    Cursor              - Up, down, left, right, home up
                        - Direct addressing, Tab
    Erase               - To end of line, to end of frame
    Erase Lock          - Prevents inadvertent erasure
    Power               - On, off
    Mode                - Remote, local
    Transmission        - Full, half duplex
```

MECHANICAL/ENVIRONMENTAL

```
Dimensions:
    Width - 19"
    Height - 12"
    Depth - 30"
    Weight - 55 lbs.
Heat Dissipation - 800 BTU/hr. maximum
Operating Temperature - 40° - 100°F, 4.4° - 37.8°C
Humidity - 10 to 95%
```

POWER INPUT

    VT05A: 95-130 VAC, 60 Hz $\pm$ 2 Hz, single phase
    VT05B: 190-260 VAC, 60 Hz $\pm$ 2 Hz
    VT05C: 95-130 VAC, 50 Hz $\pm$ 2 Hz
    VT-5D: 190-260 VAC, 50 Hz $\pm$ 2 Hz
    Power Consumption - 130 watts

DATA TRANSMISSION

    Type - Crystal-controlled, selectable speed; send/
        receive 110, 150, 300 Baud

APPLICATIONS

General-Purpose Timesharing

Timesharing systems are pioneering a new way of life in many
scientific and technical disciplines. The time spent by pro-
fessional workers at the terminal in dialog with a computer is
critical productivity time. The obviously strong need for terminal
equipment that increases this productivity is satisfied by the VT05
Alphanumeric Display Terminal. It is designed to make the pro-
fessional's "on-line" time totally useful. Also, its selectable
transmission speeds allow terminal users to utilize any available
data communication system, including simple acoustical couplers
and digital modems.

Computer-Aided Instruction

In the learning process, the VT05 terminal enables the simultaneous
display of background video images and foreground alphanumeric
information. At the elementary instruction level, foreground displays
of words and numbers can be reinforced by static or dynamic pictures
of the things themselves. The same technique is also appropriate
for advanced levels of instruction such as medical school anatomy
classes, repair mechanic training, and even photo intelligence
evaluations. The background video image can be obtained directly
from a TV camera or indirectly from a video tape player.

Hospital Systems

The VT05 fulfills all the necessary requirements for use in the
hospital environment in multi-station paging, clinical and research
applications. It is noiseless (no bothersome hum or clatter) and
consequently eliminates intrusion upon the user, patients or
subjects in the immediate vicinity. Also, it is extraordinarily
simple to operate; no instruction manual is required, so anyone
who can type can run it.

The VT05 utilizes solid-state elements, thereby guaranteeing high
reliability with correspondingly fewer maintenance problems. It
is completely portable, weighing only 55 pounds, and is easily
connected to a standard acoustical coupler or a data set even by
an unskilled operator.

The CRT screen displays a total of 1440 characters. A keyboard-
controlled cursor is operated under program control to help revise,
correct or delete any character, any line or any combination. This
control via the computer allows simple question-and-answer type
data logging to be accomplished at remote stations by non-computer
operators.

Industrial and Commercial

The VT05 is completely self-contained on one rugged, compact
package. It includes the keyboard, CRT, refresh memory, communi-
cations interface, and power supply.

The characters displayed on the CRT are refreshed 60 times per
second which obviates any flicker. A tinted glass shield is pro-
vided to reduce glare and make the VT05 visually comfortable to
use. The simple keyboard allows for rapid entry of data.

All of these features, plus its handsome modern design, make the
VT05 an ideal clerical tool for office or laboratory. With its
video capability, moreover, it can also serve as a remote monitor
for hazardous experiments or production processes; e.g., working
with radioactive materials, noxious fumes, or toxic substances.

ASCII CODE ASSIGNMENTS

STANDARD TRANSMIT CODE ASSIGNMENTS

Bit 4321 \ 765	000	001	010	011	100	101	110	111
0000			SPACE	0	@	P	@	P
0001			!	1	A	Q	A	Q
0010			"	2	B	R	B	R
0011			#	3	C	S	C	S
0100			$	4	D	T	D	T
0101			%	5	E	U	E	U
0110			&	6	F	V	F	V
0111			'	7	G	W	G	W
1000	C← (BS)	C→	(	8	H	X	H	X
1001	HT		)	9	I	Y	I	Y
1010	LF	C↑	*	:	J	Z	J	Z
1011	C↓		+	;	K	[	K	[
1100			,	<	L	\	L	\
1101	CR	HOME	—	=	M	]	M	ALT.
1110		ERASE LINE	.	>	N	^	N	^
1111		ERASE SCREEN	/	?	O	_	O	DEL (RUB OUT)

FULL ASCII TRANSMIT CODE ASSIGNMENTS

Bit 4321 \ 765	000	001	010	011	100	101	110	111
0000			SPACE	0	@	P		P
0001			!	1	A	Q	a	q
0010			"	2	B	R	b	r
0011			#	3	C	S	c	s
0100			$	4	D	T	d	t
0101			%	5	E	U	e	u
0110			&	6	F	V	f	v
0111			'	7	G	W	g	w
1000	C← (BS)	C→	(	8	H	X	h	x
1001	HT		)	9	I	Y	i	y
1010	LF	C↑	*	:	J	Z	j	z
1011	C↓	ALT	+	;	K	[	k	{
1100			,	<	L	\	l	|
1101	CR	HOME	—	=	M	]	m	}
1110		ERASE LINE	.	>	N	^	n	~
1111		ERASE SCREEN	/	?	O	_	o	DEL (RUB OUT)

RECEIVE CODE ASSIGNMENTS

Bit 4321 \ 765	000	001	010	011	100	101	110	111
0000			SPACE	0	@	P	@	P
0001			!	1	A	Q	A	Q
0010			"	2	B	R	B	R
0011			#	3	C	S	C	S
0100			$	4	D	T	D	T
0101			%	5	E	U	E	U
0110			&	6	F	V	F	V
0111	BELL		'	7	G	W	G	W
1000	C← (BS)	C→	(	8	H	X	H	X
1001	HT		)	9	I	Y	I	Y
1010	LF	C↑	*	:	J	Z	J	Z
1011	C↓		+	;	K	[	K	[
1100			,	<	L	\	L	\
1101	CR	HOME	—	=	M	]	M	
1110	CAD	ERASE LINE	.	>	N	^	N	^
1111		ERASE SCREEN	/	?	O	_	O	

CURSOR ADDRESS CODE ASSIGNMENTS

Bit 4321 \ 765	000	001	010	011	100	101	110	111
0000			1	17	33	49	65	
0001			2	18	34	50	66	
0010			3	19	35	51	67	
0011			4	20	36	52	68	
0100			5	21	37	53	69	
0101			6	22	38	54	70	
0110			7	23	33	55	71	
0111			8	24	40	56	72	
1000			9	25	41	57		
1001			10	26	42	58		
1010			11	27	43	59		
1011			12	28	44	60		
1100			13	29	45	61		
1101			14	30	46	62		
1110			15	31	47	63		
1111			16	32	48	64		

c = Cursor Function